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JANUARY 1951

The White Line
Financing Traffic Facilities
Pennsylvania Road Program
Support for the Traffic Program
Report on Highway Traffic Research
When City, Transit Officials Cooperate
Parking Needs for Shopping Centers
Psychology and Highway Markers
Selecting Intersection Types
Miami's Off-Street Parking
Uniform Traffic Laws
Roadside Problems

THE ENO FOUNDATION FOR HIGHWAY TRAFFIC CONTROL

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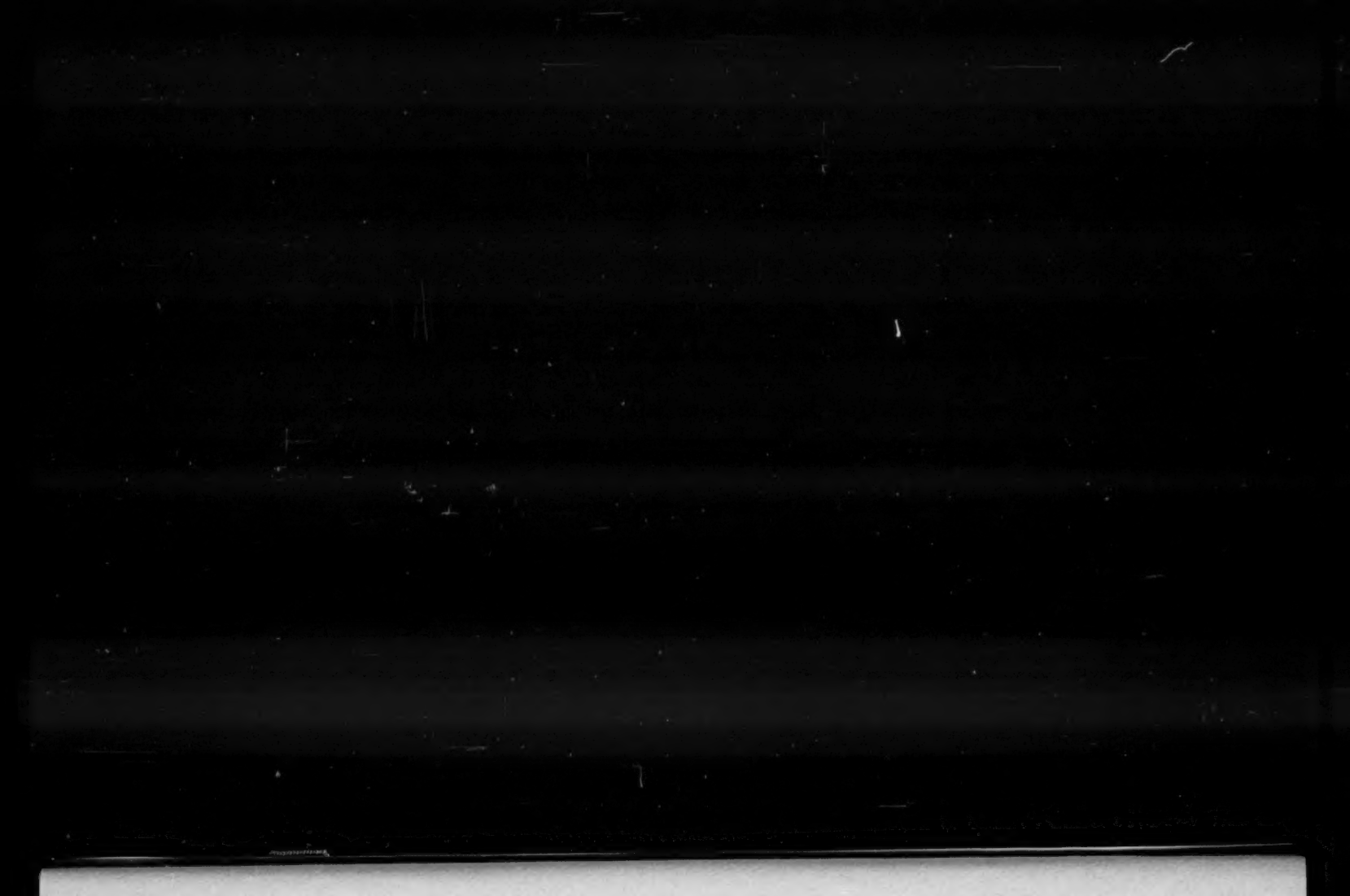

Traffic Quarterly

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The White Line

TAKE THE white line. It is doubtless the best known—and least observed—of the aids to good driving. More drivers drive on it, or over it, than to the right of it.

Yet it is one of the fairest aids. By precise measure it affords you your share of the road—no more and no less than your fellow motorist. Its careful observance is good sportsmanship.

In fair weather or bad, it is your greatest and simplest aid. There are times when inclement weather makes the white line indispensable. Variations in its use lead to some lack of uniformity but seldom to confusion.

There is no safer path for your car than your half of the road, to the right and clear of the white line that so clearly and continuously marks that half. This simple, definitive meaning has led to its general use and understanding. It leaves no excuse for violation.

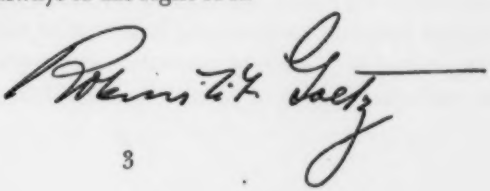
Its legal meaning may need clarification, but its intent is clear and indisputable.

Statistics show that one-fifth of rural fatal accidents and one-fourth of all rural accidents are due to medial types of collisions. A minimum of sane driving would avoid many of the indefensible acts. To drive habitually on the white line, or casually or unnecessarily to cross it, is stupid, hazardous driving that fails to receive due attention from police or proper concern by the courts.

Channel markings on our navigable waters, like line markings on our roads, serve a similar purpose. Comparative observance of laws of the sea and those of the highway presents a striking contrast.

We deserve every censure that in our country of good roads and fine cars, our great progress in transportation—a mark of progress in our standard of living—should be accompanied by our annual high accident rate and great loss of life.

Why not take the white line into our habits and sportsmanship of driving—and drive always to the right of it?



Financing Traffic Facilities

WINTHROP S. CURVIN

Mr. Curvin is Secretary of the Municipal Forum of New York, an organization devoted to the study and discussion of financial problems of municipalities. He has been active in the financing and analysis of State, County and Municipal securities for the past 15 years as a member of the firm of Smith-Barney and Company, New York which has been a major underwriter of such securities as the Port of New York Authority, the Triborough Bridge and Tunnel Authority, the Pennsylvania Turnpike Authority, the California Toll Bridge Authority, and the Delaware Memorial Bridge. This firm recently was financial advisor to the New Jersey Turnpike Authority.

WITHOUT proper financing at a favorable interest rate, the elimination of our traffic and parking problems is impossible. In these times of "easy" money and broad demand for tax-exempt securities, proper financing may be overlooked. Yet we cannot escape the fact that the painstaking work of lawyers in drafting legislaton, and the planning—and fancy—of engineers and architects are wasted unless funds are available to pay their fees and to hire the contractors. With that in mind, this article looks at practical steps in financing traffic facilities.

Elaborate and expensive toll bridges, tunnels and highways for relieving traffic congestion are a development of quite recent years, and the construction of urban parking facilities is in its infancy. But enough of this work has been done to determine rough patterns for a framework within which to work out financing for particular projects.

This knowledge is not widespread, and a city official or member of a newly created Authority, charged with responsibility for financing, constructing and operating a multimillion dollar enterprise, is faced with a bewildering maze of decisions and details for which past experience has given him only general preparation. His local banker is unlikely to have the experience necessary to determine how to proceed in drawing up a financial instrument to attract investors, to

offer adequate protection to bondholders and provide the Authority with the flexibility essential to successfully operating the project.

A conscientious officer will not leave to chance the choice of engineering and legal advisors: he will seek the best from the limited field of those known to be expert and widely experienced in undertakings of this type. Nor can he afford to choose casually the investment banker who will act as advisor or underwriter of the securities that must be successfully marketed before a step can be taken toward the actual construction. Much as he selects attorneys or engineers —on the basis of their nationwide reputation for capable handling of similar problems—he should chose an investment advisor experienced in financing traffic facilities.

Too many projects of this type have been handicapped by inadequate fiscal advice. It is necessary to emphasize that attorneys, engineers and bankers must work as a coordinated team if successful financing and operation of the facility are to be achieved and costly errors in set-up and presentation of the bond issue avoided.

In many states, statutes permit the private sale of revenue-supported securities to investment groups, and because of the individual characteristics inherent in projects of this type, that method of financing is generally preferred. Major facilities like the Pennsylvania Turnpike, the various Triborough Bridge and Tunnel Authority units, Delaware Memorial Bridge, San Francisco-Oakland Bay Bridge, Mystic River Bridge and Maine Turnpike, among others, could scarcely have been financed initially in any other manner.

Securities of these issues follow certain general principles of sound finance, but differ in so many major respects that careful discussion among legal, engineering and financial experts is prerequisite to offering securities to the public. In many instances, an investment banker introduced into the picture early can be of assistance in preparing the authorizing legislation, offering advice in the selection of attorneys and engineers, and, in some cases, underwriting the cost of preliminary legal and engineering surveys to determine the feasibility of the proposed facility. The latter service has proved particularly important in instances where the authorizing legislation failed to allocate adequate funds or make provision for resources for these purposes.

In some cases, fortunately in the minority, public bidding is re-

quired for issues of bonds for new toll-supported projects. This procedure lessens the solidarity of interest among lawyers, engineers and underwriting banker which historically has operated to maintain the high level of quality generally characteristic of outstanding bonds of this category. Still the Authority can achieve a similar end by employing a qualified investment banker on much the same footing as lawyers or engineers, in the capacity of "Fiscal Agent." In that position the banker should be expected to provide such services as: (1) assist in the selection of attorneys and engineers; (2) assist the attorneys and trustee in preparing the trust agreement or authorizing resolution; (3) prepare an official statement for the information of prospective bidders; (4) discuss the financing with institutional investors and bond rating agencies; and (5) give information to bidders and represent the issuer in solving problems and answering questions prior to the receipt of bids.

Whether acting as underwriter or financial advisor, the experienced investment banker guards his reputation for marketing well-drawn and adequately-secured investment media, recognizing his obligation to both seller and buyer of the obligations he sponsors. In this respect his interests are identical with those of attorneys and engineers who likewise survive in highly competitive fields only so long as they consistently maintain a favorable reputation.

It would facilitate the financing of projects of this type if it were possible to set forth a rigid pattern for use in drawing up the bond resolution or trust agreement. Unfortunately, as has been pointed out so many times by bankers and attorneys, each issue must be set up individually and each trust agreement tailormade to fit the peculiarities of the specific circumstances. This is not to say, however, that it is impractical to follow certain fundamentally sound principles and procedures in the financing, some of which, by common and repeated usage, become somewhat stereotyped. Among the basic principles may be included the following:

Economic Necessity

Basic to the success of any new enterprise is the extent to which the public, by continued voluntary use, will support the project in preference to alternate routes or facilities. In financing a publicly owned

water or sewer system, a bondholder may rely to a degree upon the power of the issuing authorities to compel property owners to become customers, and in purchasing bonds payable from general taxation he need have little interest in whether or not there is a definite need for the facility constructed with the bond proceeds, so long as the issuing municipality may force all residents to pay the supporting taxes.

However, when he must look only to the public's voluntary use of the facility in competition with other public or private enterprises, an investor must be convinced that there is, and will continue to be, a real need for the project and that the prospective tolls are not so high as to offset the competitive advantages offered by the project. This is a most important basic consideration. The issuer must recognize, in selecting his engineers, that the banker and the investor, as well, look to the reputation of the engineers in forming their opinion as to the economic necessity for the facility, and a pecuniary saving or the sponsorship of unproven experts at this junction is certainly false economy.

Tolls

Usually the legislation authorizing the creation of an Authority or empowering a subdivision to construct and operate a traffic facility prescribes the charging of tolls for the use of the facility and stipulates that such tolls or charges may be determined in the sole discretion of the responsible officials, with or without public hearing. It remains for the Authority members or city officials to implement the legislation by prescribing in its contract with the bondholders the level at which the tolls will be assessed and the conditions under which the tolls may or must be modified. The usual covenant requires the establishing of initial tolls as recommended by the traffic engineers and the charging thereafter of rates at a level to produce revenues sufficient to cover operating expenses, debt service including mandatory sinking fund payments if any, and payments to various reserve funds.

A concept incorporated in some recent covenants is that of permitting a lowering of tolls if, in the opinion of the consulting engi-

neers, such lower tolls are likely to increase revenues or produce a greater volume of traffic without impairing the position of the bondholders. The ideal to be achieved is the maintenance of the greatest flexibility possible consistent with the issuer's obligations to fully protect the bondholder's interest, and the conditions involved in any particular project will obviously dictate the practical limits of the discretion granted to the operators of the project.

At one point no deviation from historical procedure is permissible--*neither the Legislature nor any of its creatures should be empowered to interfere in any manner with the establishment and maintenance of adequate toll schedules.* The absence of political interference or control is a cornerstone of investor confidence in American revenue-supported public enterprises.

Equity Financing

Investors accustomed to purchasing corporate securities found it difficult for many years to adjust themselves to investment in revenue-supported projects where all of the construction funds are derived from the sale of first lien bonds. But in recent years this argument seldom arises. On rare occasions equity has been provided through sale of junior lien bonds, and more frequently grants or subordinated loans by State or Federal Agencies have provided a cushion for the general lien bondholder, but the customary procedure calls for nearly 100 per cent financing by first lien bonds supported by pledge of adequate tolls and conservative reserves. Equity of a sort is provided in the exemption of the project from Federal, State and local property and income taxes, thus assuring that the entire net operating receipts will be available for bond service.

Bond Maturities

The individuality of revenue-supported traffic facilities is possibly most marked in the choice of bond maturity schedules. For new and untried projects, the most conservative course is to establish a single term maturity within the limits prescribed by the authorizing legislation, and sufficiently far in the future to assure that interest require-

ments and minimum sinking fund payments can be met even though the earnings anticipated by the traffic engineers fail to materialize, for one reason or another. Lack of careful planning at this point or failure to take into consideration possible contingencies due to changing traffic conditions may result in inadequate coverage for bond service requirements and potential forfeiture of the savings inherent in the possible refunding of the bonds at a lower interest rate or with shorter maturities after the project commences to show earnings. Once in operation, and having shown favorable earnings for a period of time, refinancing is often possible at a saving of interest.

In such a refinancing, a serial bond issue or a combination of serial and term bonds usually may be substituted for the original term bonds, giving a greater degree of rigidity to the annual bond service requirements but reducing the average life of the bond issue materially. In connection with the maturity schedule, careful attention must be given to the schedule of redemption prices so as to assure adequate protection to the bondholder on the one hand and not penalize the project if earnings are such as to make refinancing practicable. Obviously, no formula will be applicable to various bond issues, the call price and call date depending upon various circumstances. *No project of this type should be financed with non-callable bonds.*

Pledge of Revenues

By custom, the lien of bondholders upon the earnings of traffic facilities is subordinated only to that of actual current operating expense accounts. In a few instances, debt service has been accorded the first position among revenue pledges as set forth in the trust agreement, but this is clearly a subterfuge since the bondholder is protected only so long as wages and other current bills are paid. The only logical reason for placing the bondholder first is involved in the theory that, if an increase in tolls or changes is necessary, it may be easier, politically, to effect such an increase if it may be said that it is essential to pay employees and other local debtors rather than to pay non-resident bondholders. This theory is, however, not widely accepted.

After payment of current operating expenses (including salaries,

wages, insurance premiums and fees of engineers, attorneys and trustees and ordinary maintenance), current debt service including sinking fund payments, if any, and payments to the bond reserve funds, the balance of the gross revenues must be allocated by specific pledge, in manner and amount satisfactory to bankers and engineers, to various other purposes such as renewal and replacement, extensions and improvements, in lieu payments to local political subdivisions and retirement of bonds in advance of their maturity. Again, there is little uniformity among various projects in the manner in which this flow of funds is accomplished, although the precedence of the various funds in approximately the order shown is widely accepted.

It is essential that all funds of the issuer, except petty cash, be adequately secured in solvent banks and that all funds set aside for the benefit of the bondholders, including all reserve funds, be carefully segregated under arrangement with an independent trustee. The trustee should be empowered to disperse funds from the reserves only upon properly authorized written instruction from the designated official of the issuer. The trustee should be a bank of nationwide reputation if the issue is a sizeable one.

Reserves

Already cited as one of the outstanding features of the revenue-supported bond, along with the uninhibited power to charge adequate tolls, is the provision for reserve funds. These take several forms, the amounts varying considerably among projects. Essential in a project involving new construction is a *reserve for contingencies in construction cost estimates.* Naturally the amount of this reserve will depend upon the relative scarcity or availability of materials at the time of construction and will be determined by the engineers with approval of the issuer and bankers at a level calculated to assure that the bond proceeds will be sufficient to complete the project and place it in operation. There must also be founded a reserve sufficent to pay interest during construction and for such reasonable period of time thereafter as to obviate any early difficulty in the prompt payment of interest.

To assure there being available at all times funds sufficient to

pay current operating expenses, there should be established an *operating fund reserve* which may take the form of a revolving fund from which funds may be drawn as needed and reimbursement made at the end of each month.

The principal reserve established directly for the benefit of the bondholder is the *bond reserve fund*. The amount deposited in this fund is subject to rather wide variation depending upon the issue. Conservative practice dictates the accumulation of a reserve of a minimum of two years' interest requirements if the bonds are all term in form, or one full year's principal and interest requirements if the bonds are all serial. If a combination of serial and term bonds is used, a fixed dollar amount is usually required at a level sufficient, in the opinion of the banker and the issuer, to protect the investor in event of a decline of earnings. The maximum reserve fund should be accumulated from earnings as quickly as possible as a protection not only to the investor but to the issuer as well. Moneys in the reserve fund are available to pay debt service in the event that net operating revenues prove insufficient for that purpose, and prompt reimbursement of any expenditure is required.

Other customary reserves include the *renewal and replacement reserve* established at a level recommended by the consulting engineers for defraying the cost of unusual items of maintenance and replacing worn or damaged portions of the facility. Ordinarily a separate depreciation reserve is not required for facilities of this type unless there is involved a substantial amount of short-lived equipment.

The majority of the toll projects are insured in amounts and for purposes recommended by the consulting engineers. If for some reason this condition does not exist, there must also be established an *insurance reserve* over and above the renewal and replacement item.

Additional Indebtedness

Obviously an investor who purchases bonds to finance a traffic facility has no desire to leave the trust agreement entirely open-end as regards the issuance of additional parity obligations, and he is entitled to protection against the possibility of excessive dilution of the earn-

ings applicable to payment of debt service. The degree to which the indenture may be opened to permit sale of additional bonds will depend to a large extent upon the nature of the project. For example, in the financing of a toll bridge there is clearly less justification for such a provision than in the case of a parking garage which may constitute one unit of a broad parking facility program. In any event, the issuer must fulfill certain specific covenants prior to issuance of parity securities, including the punctual performance of all bond covenants pertaining to the then outstanding indebtedness and the showing of earnings adequate to protect holders of both outstanding and proposed additional bonds. The debt service coverage which is considered "adequate" will, of course, vary considerably as between different types of projects with limits from about 1⅛ to 1¾ times.

Progress Reports

It is extremely important to the maintenance of a successful and orderly market for bonds that there be available adequate and timely reports of traffic and both gross and net operating revenues. During the period of construction, monthly progress reports of the consulting engineer should show not only how nearly the cost estimates approximate the actual costs, but also should keep investors advised of any construction delays or unforeseen difficulties. By publishing adequate information, the issuer avoids the spread of rumors which can often prove embarrassing to both himself and his banker.

In summary, it may be said that the essential steps in the successful financing of revenue-supported traffic facilities, whether toll roads or bridges, tunnels or parking garages, are:

1. Be certain that the authorizing legislation is properly drawn to permit the appointment of capable, non-political, governing officials and the drawing of a flexible bond indenture, and to provide, among other things, for condemnation of property, tax exemption of income and properties of the project, levy and collection of tolls without interference or regulation by any other agency, and appropriation of funds to advance preliminary investigations.

2. Seek the services of able and experienced bond attorneys, engineers and bankers to determine the economic feasibility of the proj-

ect and prepare for marketing a bond issue which will attract the lowest possible interest rate.

3. In making covenants with bondholders, follow accepted practice in the matters of toll adjustments, pledge of revenues, setting up of adequate reserves, etc., but recognize that each project has individual characteristics and cannot exactly parallel any other in all respects. Short cuts or improperly drawn bond covenants are costly to the issuer.

4. During construction and after operation commences, make every effort to keep the investor informed of progress in as great detail as economically possible.

A Topical Report on Highway Traffic Research

ROY W. CRUM

Since 1928, Mr. Crum has been Director of the Highway Research Board of the National Research Council for highway transportation and engineering. For nine years prior to 1928, he was Engineer of Materials and Tests for the Iowa State Highway Commission. From 1907 to 1919 he was a teacher and research worker in the field of civil engineering at his alma mater, Iowa State College. During parts of 1906, 1907, and 1910 he served as a civil engineer for the Pennsylvania Railroad. He is a member of the American Society of Civil Engineers, a Fellow of the American Association for the Advancement of Sciences, and the author of articles and research reports on highway engineering.

MY CHILDREN are of the first generation to grow up with motor cars. Since we are in only the second generation of motor vehicle users, it is not surprising that all of our highway traffic problems have not been solved. The human race needs longer than that to adapt itself to new environment. Indeed we can be sure that the traffic behavior pattern is still forming and will continue to change for a long time.

It would be impossible now to freeze traffic habits into any particular pattern, even if we knew what habits were desirable. Yet by study of past performance and present action it may be possible to influence human adaptation to the motor vehicle along desirable lines, and thus save time in handling highway transportation with safety, efficiency and economy.

Research is the end activity, after a process of reduction from a broad view of a certain field of knowledge through successive stages of screening, to an individual project susceptible of detailed attack.

This article will, in some measure, follow this process in discussing the problems of highway traffic engineering and what is being done about them.[1] It is well to contemplate broad areas of interest

[1] No attempt is made here to cover the broad field of highway safety research: That is another story.

preliminary to detailed work, but to produce results it is necessary to break the job into bites small enough to masticate.

More than 43 million automobiles, buses and trucks travel freely up and down the roads of the nation; a great deal of the time at the highest speed that conditions will permit. Most of this travel is upon the 709,000 miles of paved streets and roads and amounts to 398 billion vehicle miles a year.

The right to pass is a fundamental tenet of the American way of life but in the struggle to provide facilities for free and speedy movement of vast numbers of individual vehicles, the country has become involved in complicated sociological, economic and physical problems.

To highway engineers concerned with planning and traffic come problems of fitting the users to existing facilities and of providing information by which designers can fit the roads of the future to the people.

Roads must be provided whereby the people may go where they want, when they want, safely and expeditiously, within reason. "Within reason" brings up another basic tenet of our system: All activities must be in reasonable relation to the public good as defined by the majority.

One thing we know about highway traffic and road building: roads must be built to conform to what the users need and want. Like all generalizations, that statement is not strictly correct; the users' wants must be within reasonable limits, but there is enough truth in it to set the path that traffic research must follow.

It is evident that the pattern for traffic research divides itself into two parts: (1) Study of human behavior on the road (at the wheel and on foot) and (2) Engineering studies of methods to adapt roads to the behavior, needs and desires of the majority of road users who are reasonable people. It is futile to attempt to adapt the road to the maverick fringe whose behavior is unpredictable and who have no spirit of conformity.

Among the reasonable majority are many who need education in good practices. Many, however, have unfortunate characteristics for which road design should provide maximum possible compensation. For instance, although color is useful in highway signals, the signals

should be designed to carry the message to the color-blind minority.

A basic fact is that the majority of highway users are reasonably careful and mindful of the rights of others. Mishaps are born of complicated situations, often entirely beyond their control. It is important to identify congenital non-conformists, accident-prone individuals and those needing and susceptible to education. In this paper, however, we are concerned with the social, psychological and economic research involved in plotting the basic pattern of the majority's behavior and desires, and in physical research involved in adapting the road to that pattern.

An aim of traffic engineering research is to enable the designer to plan roads over which vehicles may move quickly and safely in accordance with the wishes of the users, provided the user is willing to be confined by necessary conditions. Such factors as maximum speed, gradient, curvature and width must have reasonable limits.

Research must define the allowable limiting conditions of traffic behavior and the physical limits of the facilities. It must concern itself also with regulatory means to compel observance of the limits and with educational ways to teach an understanding of them. If everyone understood and observed proper limiting conditions, there would be little left of the behavior problem.

In 1944 in discussing "The Traffic Engineer's Place in Highway Research"[2] I said there were three research needs in the field of traffic and operations: the need for fundamental data, the need for hard work, and the need for correlation of knowledge and coordination of work.

In the intervening five and a half years, much has been done to produce basic data and arrange far-reaching facilities for correlation of highway research and interchange of information. But it takes longer than five years to produce developments that may be generally seen and recognized. To the traffic engineer, important improvements are discernible. The results of research lie in the integration of innumerable activities of many men, and only rarely is some achievement in engineering research spectacular enough to attract widespread attention. One such event in this period should be mentioned. It marks a definite milestone. This is the studies by O. K.

[2] 1944 Proceedings, Institute of Traffic Engineers, p. 68.

Normann and his associates of the Bureau of Public Roads and Highway Research Board which culminated in the much needed "Highway Capacity Manual."

From a survey made by the Highway Research Correlation Service in 1945 and 1946 the six most important areas of traffic research suggested by the State Highway Departments were listed as follows in order of need by the Traffic and Operations Department of the Highway Research Board:

1. Studies of Capacity; 2. Channelization of Traffic; 3. Traffic Engineering Functions; 4. Speed Zoning; 5. Signs and Markings; 6. Signals.

It may be noted that all of these involve studies of human behavior.

Compare this list with current activities deemed important at this time by the Traffic and Operations Department of the Highway Research Board as evidenced by the research committees of the department which are:

1. Parking; 2. Origin and Destination Surveys; 3. Influence of Shoulders on Traffic Operations; 4. Uses of Highway Planning Survey Data; 5. Vehicle Characteristics; 6. Operating Speeds in Urban Areas; 7. Roadway Pavement Markings; 8. Channelization; 9. Speed Control; 10. Effects of Traffic Regulation on Business; 11. Urban Traffic Volume Characteristics; 12. Road User Characteristics; 13. Enforcement Practices on Truck Sizes and Weights.

Thus, in selecting areas in which to work, the department has extended and broken down into more usable sizes the six principal questions asked by the State highway departments. Most of these subjects must be broken down further to make attackable projects. At a meeting of the department on February 6 and 7, 1950 interest was expressed in the following as possible research projects:

Warrants for Control Devices; Perceptibility of Traffic Control Devices; Effects of Signs on Road User Behavior; Inexpensive Origin and Destination Surveys for Small Cities; Evaluation of Route Performance; Effects on Operations of Curbs and Media Dividers; Prediction of Traffic Volumes.

But, now, the natural question arises: What is being done about all this? It takes more than committee discussions, listings of desirable projects and organization of committees to produce results that will

raise the level of technical practice. We must get to work and do a job of painstaking scientific fact-gathering before anything tangible can result.

So, let us look at the record. Here is an abstract from the annual report of Professor Wilbur S. Smith, Chairman of the Traffic and Operations Department of the Board.

During 1949 the principal activities of the Traffic and Operations Department were divided among eleven project committees on which 149 technically qualified members have been serving. The Department itself consists of twenty-five members, twelve of whom are also serving on the various project committees. Under the Department's direction the eleven project committees were engaged in specific fields of study and research relating to traffic operation and management. As a result several of the committees have prepared reports for publication including a "Manual on Highway Capacity," a brochure on the "Effect of Controlled Access Expressways on Urban Areas" and a Supplement to "Selected Bibliography on Highway Safety."

The Committees' activities to date are summarized as follows:

Parking: A parking symposium on important aspects of the parking problem. During 1950 emphasis was placed on financing and administering off-street parking facilities.

Origin and Destination Surveys: A compendium of accepted origin and destination survey techniques.

Influence of Shoulders on Traffic Operations: Through the individual committee members speed and placement studies are being made in several States.

Uses of Highway Planning Survey Data: This committee, sponsored jointly by the Department of Economics, Finance and Administration and the Traffic and Operations Department, is preparing a manual of twelve chapters dealing with the use of planning data in the highway field. Ten chapters have been completed, two are in preparation.

Effects of Controlled Access Expressways on Urban Areas: A report consisting of sixteen chapters relating to location, design, and construction of the expressway and its appurtenances and its effect on adjacent urban areas.

Vehicle Characteristics: Devices for measuring and recording

engine torque, speed, throttle opening, and fuel consumption have been developed. The Committee has been given a grant by the Automobile Manufacturers' Association to employ a staff engineer to conduct a year's pilot study in testing and using the instruments. A proposed test program has been mapped out.

Bibliography of Highway Traffic Safety: A first supplement to the bibliography of 1947 has been issued. The Committee will continue to assemble additional listings to be published either in a revised bibliography, or as future supplements.

Operating Speeds in Urban Areas: A report on various techniques for measuring over-all speeds on urban streets has been completed.

Roadway Pavement Markings: The Committee has been active in stating problems, developing techniques, and encouraging qualified agencies to undertake research work in this field.

Channelization: During 1950 examples of good and bad channelization were sought, and behavior studies made on certain elements of design.

Next, for a brief summary of specific activities in traffic research the following from a report by Byron Bledsoe, Assistant Traffic Engineer of the Highway Research Board may be of interest.

Highway research in traffic and operations may be divided into four classes: planning, functional design, traffic characteristics and regulations.

Highway planning surveys are continuing in all of the states and represent a large portion of the traffic and economic research. They include traffic volumes and patterns necessary for both long- and short-range planning and in some states are supplemented by origin-destination surveys of specific areas. The traffic survey recently started in Miami by the Florida Road Department is typical. The controlled postal-card type of O-D survey as used in Franklin County, Ohio, has been of interest to traffic engineers.

Studies to relate population and travel in urban areas were undertaken in Missouri and North Carolina, as well as comprehensive surveys in Albuquerque, New Mexico and in Evansville, Indiana, under the direction of the Automotive Safety Foundation.

Refinements of existing instrumentation and development of

new instruments for more efficient and accurate collection of traffic and planning data are being studied. Notable among these efforts are those of the University of California in the application of electronic techniques to traffic instrumentation and of the Minnesota Highway Department in the development of procedures and equipment for conducting critical feature surveys.

In Functional Design, studies are progressing in twenty states to relate accident occurrence to the design features of the highway. In Minnesota this study is extended to show the influence of highway access points and roadside development on accident occurrence. In Missouri the highway department is analyzing a study of the effect of the quarterpoint barrier stripe on driving practice.

The effects of drive-in theaters on traffic operations are being felt widely and the Traffic Sub-Committee of the American Association of State Highway Officials is preparing a report that treats of the operational characteristics and traffic design features of drive-ins and recommends a uniform policy for their regulation.

Considerable interest is apparent in the design of traffic separators and other types of channelization as a means of reducing accidents and congestion. The current project of the Highway Research Board Committee on Channelization is the collection of examples of channelization from all sections of the country. The Texas Experiment Station has just completed a bibliography on channelization as the first step in a study to analyze current trends in the application of curbs and separators and to suggest improvements in their design and use.

The effects of shoulders on traffic operations is included in the long-term program of the University of California.

Research in *Traffic Characteristics* divides itself into studies of vehicle characteristics, driver behavior, and road characteristics. A basic study relating to the performance of the vehicle is that of the Highway Research Board Committee on Vehicle Characteristics. Initial studies using the instruments developed by the Committee are in progress on the streets of Detroit and will be extended later to rural highways.

Brake tests have been completed in Maryland, California and other states by the Bureau of Public Roads and are continuing in

Michigan. The Bureau is also conducting controlled brake tests on the west coast in cooperation with trucking firms.

The Joint Committee on Winter Driving Hazards of the National Safety Council has recently tested various types of tires for resistance to skidding on ice and snow. The Arizona State Highway Department has recently completed speed studies of heavy trucks and combinations on up-and-down-grades to show the relation between vehicle weight, horse power, speed and gradient. Iowa State College is organizing a project on vehicle operating costs including truck operation.

Studies of driver behavior include observations of various maneuvers and their effects on accidents and road capacity. Examples are noted in the lateral placement measurements and speed observations being conducted by the Bureau of Public Roads in cooperation with many state highway departments, city traffic engineers and other organizations.

Transmission characteristics of highways are being studied by a number of agencies including the Yale Bureau of Highway Traffic and the state highway departments of Connecticut, Kentucky and Minnesota. The recently published Highway Capacity Manual will serve as a basis for further studies of turning movements, parking maneuvers, and weaving practices such as are being conducted by the University of California and others. Another approach of interest is being developed by the Iowa State Highway Commission in its comparison of relative hazards of highway intersections and highway-railway grade crossings based on the theory of probabilities.

Research in *Regulation and Control* is making progress, particularly in the improvement of regulatory devices. Traffic paint is being studied widely for the purpose of obtaining greater reflectivity and durability. The highway departments of Michigan, Missouri, North Carolina, Vermont, Virginia, Washington, and Minnesota are active in this regard.

Others are observing driver reactions to markings, signs and signals. In Nebraska, the effect of placing a no-passing stripe in cities is being studied. Kentucky is studying driver reactions to reflectorized signs and markers correlated with exposure tests of samples. The Texas Experiment Station is planning a study on the development

of a semipermanent center stripe in cooperation with the state highway department. The University of Michigan and the National Automobile Transporters Association are conducting a poll of drivers' opinions on existing pavement marking systems covering 6,000 drivers engaged in interstate hauls.

The Michigan State Highway Department and the University of California are studying the observance of speed regulations under various conditions.

The City of Chicago, the Chicago Park District and the Illinois Division of Highways are jointly determining the effects of eliminating the red-amber before green on traffic signals. The University of California is cooperating with the state highway department to check accident experience and performance at major intersections following installation of signals, illumination, channelization and other improvements.

The Yale Bureau of Highway Traffic is using sales tax information to determine the effects of one-way street regulation on business.

For many years the Highway Research Board in cooperation with the American Association of State Highway Officials has kept a record of highway research projects and reports. The current projects in progress or recently reported upon are listed in the Highway Research Review, Series 1, Number 3, of June 1950. They give a good picture of the activities in traffic research. They are summarized as follows in relation to the committee set-up of the Highway Research Board.

Parking: Traffic Survey Parking Study, Portland, Oregon; Requirements for Off-street Parking Facilities in Zoning and Other Local Ordinances, Bureau of Public Roads; Parking Meter Problems, Bureau of Public Roads; Off-street Parking, University of California; Effect of Building Space Usage on Traffic Generation and Parking Demand, Johns Hopkins University; Economic Aspects of Parking Accommodations, Vancouver, B.C.; Time-Motion Relations in Operation of Garages, New Haven, Connecticut; Legal, Administrative and Financial Aspects of Urban Parking Surveys, Bureau of Public Roads; Travel and Parking Habits, Bureau of Public Roads; Effectiveness of Parking Meters, Chicago; Fringe

Parking, Bureau of Public Roads; Gross Sales Volume as a Measure of Parking Demand, Grand Rapids, Michigan.

Origin and Destination Surveys: O & D Surveys in Arizona; East St. Louis, Illinois; Iowa State College campus; Meadville, Pennsylvania; Tacoma, Washington; Bluefield, West Virginia; Montgomery, West Virginia; Green Bay, Wisconsin; Portland, Oregon; Philadelphia, Camden Metropolitan Area, Reading, Pennsylvania; Franklin Company, Ohio; Elkhart, Indiana; Calumet District, Indiana; Washington, D. C.; Canton, Ohio; Fairmont, West Virginia.

Studies: Coordinate Method of O & D Analysis, California; Minimum Time Periods, Louisiana[3]; O & D Survey Analysis, California; Analytical Procedures for Metropolitan Area Traffic Studies, Michigan.

Influence of Shoulders on Traffic Operations: A study to investigate surface characteristics, color and width of treated shoulders in relation to how motorists use the shoulder under different traffic volume conditions, Institute of Transportation and Traffic Engineering, University of California.

Uses of Highway Planning Survey Data: Relation of Traffic Movement to Land Use and Marketing Centers, Colorado; Railroad Grade Crossing Rating Formula, Utah; Evaluating Hazards at Railroad Grade Crossings, Mississippi; Railroad Grade Cross Study, West Virginia.

Accident Rates as Related to Roadside Business and Advertising, Michigan, Minnesota, Iowa State College; Accident Analysis for Program Planning, Connecticut; Inventory of Principal Intersections, University of California; Zonal Analysis of Highway Accidents, Accident Probabilities of Highway Intersections and Railway Grade Crossings, Iowa; Relation of Traffic Accidents to Physical Elements of Highways, Minnesota; Traffic Accident Analysis Coding Manual, Oregon.

Trip Cost Data, Arizona; Traffic Surveys, Boise, Idaho; Allentown-Bethlehem, Pennsylvania; Great Smoky Mountains; Wheatland, Wyoming; Survey of Foreign Passenger Cars, Virginia.

Vehicle Characteristics: Performance of Trucks on Mountain

[3] Name of State when alone indicates State Highway Department.

Grades, Arizona—Uphill Speeds of Trucks on Mountain Grades, Arizona.

As a special project the Committee is developing devices for measuring and recording engine torque, speed, throttle opening and fuel consumption.

Operating Speeds and Speed Control: Techniques for Measuring Overall Speeds in Urban Areas, University of California—Speed and Delay Techniques, University of California; Advance Warning for Speed Zones, University of California; Speed Zoning Practices, Michigan; Speed Control, A. A. S. H. O. Sub-Committee.

Pavement Markings: Semi-Permanent Center Stripe, Texas A. & M. College; Reflex Reflector Performance Criteria, University of California; Design and Use of Reflectors, Reflexite Corporation; Specifications for Reflectorized Signs and Markers, Michigan; Reflectorizing Surface Materials for Signs and Markers, Kentucky; Safe Speed Indications at Curbs, University of California; Reflective Material on Highway Signs, Utah; Aluminum Sheet Metal for Highway Signs, Utah; Effectiveness of No-Passing Zone Markings, Missouri; Effects of Placing No-Passing Zone Striping in Cities, Nebraska.

Of allied interest are ten research projects dealing with traffic paint, North Carolina State College; Missouri; Pennsylvania; Michigan; North Carolina; Vermont; Virginia; Washington (two) and Minnesota.

Channelization: Application of Channelization in Design of Intersections, A. & M. College of Texas.

Road User Characteristics: Improving Driver Training, American Automobile Association; Lateral Placement of Vehicles Approaching Pony-Truss Bridges, University of California; Technique for Evaluating Certain Obstacle Effects of the Driving Environment on the Driver, University of California; Usefulness of Motion Picture Technique for Isolating Significant Variables Comprising Driver Behavior, University of California.

Pedestrian Habits at Street Intersections, University of California—Characteristics of Pedestrian Subways in Relation to Low Frequency Use by Adults, University of California.

As yet no research projects have been catalogued that have ob-

vious relevancy to the three new Committees, *Effects of Traffic Regulations on Business, Urban Traffic Volume Characteristics* and *Enforcement Practices on Truck Sizes and Weights.* A few other projects and reports are listed under topics not, at the moment, the subject of committee work by the Traffic and Operations Department.

Economics: Economics of Traffic Performance, University of California; Time Saved to Motorists, New Jersey.

Instrumentation: Road Performance Meter, University of Kentucky; Current Technical Activities in Traffic Law Enforcement, Federal Bureau of Investigation; A Segmented Electrical Element for Detecting Vehicular Traffic, University of California; Application of Electronic Techniques to Traffic Instrumentation, University of California; Vehicle Speed-Distribution Recorder, University of California.

Signals: Traffic Signal Inventory, Maryland; Color Sequence in Traffic Signal Lights, Chicago, Illinois.

Traffic Capacity: A Rural Highway Congestion Index, Minnesota.

The foregoing listing of traffic research is by no means a complete bibliography on the subject. However the items well illustrate the sort of working projects into which broad areas of research attack must be broken down.

The record of traffic research projects is indeed impressive. Nevertheless it is hardly commensurate with the importance of this sector of human affairs. Many gaps in the current search for knowledge are apparent. Extension of research in traffic must be urged and promoted.

Fortunately we are not completely dependent upon formally organized research projects for technological advancement. Engineers are experimenters, and the work of the engineers engaged in traffic engineering shows that practically everything they do adds new knowledge or shows the way to better utilization of knowledge we already have.

On the whole, the outlook is good.

Selecting the Intersection Type by Traffic Volume: a Chart

W. R. BELLIS

Mr. Bellis, a civil engineer, is Chief of the Bureau of Traffic and Safety Research under the direction of O. H. Fritzsche, Director of the Division of Planning, Traffic and Economics in the New Jersey State Highway Department. He has been with the Highway Department since 1927. He served as Highway Traffic Engineer with the Armed Forces in Europe during World War II.

SELECTING the best type of intersection to satisfy traffic volumes that will use it, and also staying within the range of reasonable economy involve careful consideration of many factors. Of course, so far as traffic is concerned, a grade separation is the ideal treatment. But available funds are severely limited so that only a very few of the intersections with highest economic justification can be provided with grade separations.

Highway engineers know what vast sums of money it takes to provide grade separations but the general public has a very poor concept of these costs. Laymen discussing the building of a simple intersection at grade, will conclude that the Highway Department should have added a little more money to the project to provide a modern grade separation with interchange ramps eliminating cross traffic. The simple project costs about $30,000 whereas the grade separation they had in mind might have cost $400,000. Some urban grade separations may cost a million and a half dollars or more, depending on the cost of right-of-way.

The intersection of two roads must at least be a simple intersection at grade. In some states along state highways the cross roads must be controlled by "Stop Street" signs. This is also true along other roads where the minor roads are designated as "Stop Streets." Some intersections are important enough to be worth a better type of traffic regulation than the minimum. One of the major factors to consider is the volume of traffic using the intersection.

It is logical to assume that as the traffic volume increases an inter-

section deserves improved control by installing traffic signals and later by building a grade separation. The volumes at which certain types of intersections are indicated must first be determined by experience.

New Jersey Uses Diagram Data

At the present time many intersections are controlled by grade separations and ramps. If we could tabulate the conditions leading to the adoption of the intersection improvement, we would be able to formulate a standard of criteria by which to be governed. The diagram selection of intersection type was developed in the New Jersey State Highway Department from such data. Although the available data were not as complete as desired, the diagram has proved to be reliable in subsequent selections. Data are now being collected to provide a reliable source of information which will be available for future probable adjustment of the criteria.

In the diagram, a 30th peak-hour volume of 100 approaching from one direction on road A and a 30th peak-hour volume of 500 approaching on road B calls for a traffic-actuated traffic signal. Traffic approaching from the major direction of each road governs. With 100 cars per hour on road A and 1,000 per hour on road B, a grade separation is indicated. When there are 600 per hour on road A and the same on road B, a grade separation or a traffic circle is justified. The present trend is to discourage the use of the traffic circle on high speed highways.

When volumes are equal on the two roads, no control or "Stop Street" control is indicated for all volumes between 1 versus 1 and 170 versus 170 per hour. A traffic signal is needed for all volumes between 170 versus 170 and 370 versus 370 cars per hour. A traffic circle or grade separation is indicated for all volumes between 370 versus 370 and 1140 versus 1140 cars per hour. For volumes greater than this only a grade separation will satisfy.

It would probably be proper to indicate a distinction between no control and stop street control but this diagram was intended for use on the New Jersey State Highway system where all highways are designated as through roads at which traffic on cross roads must stop. Stop street signs are erected at all such intersections.

Traffic Volume Determines Control

The fixed-time traffic signal is indicated for evenly distributed volumes of between 170 versus 170 and 370 versus 370, and deviating from even distribution up to a ratio of 4 to 1 distribution of traffic. It is not intended that traffic-actuated signals should not be used for these volumes. They are recommended where, during the off peak hours, the volumes are small. Where traffic-actuated signals are used, they operate similarly to fixed-time during peak hours.

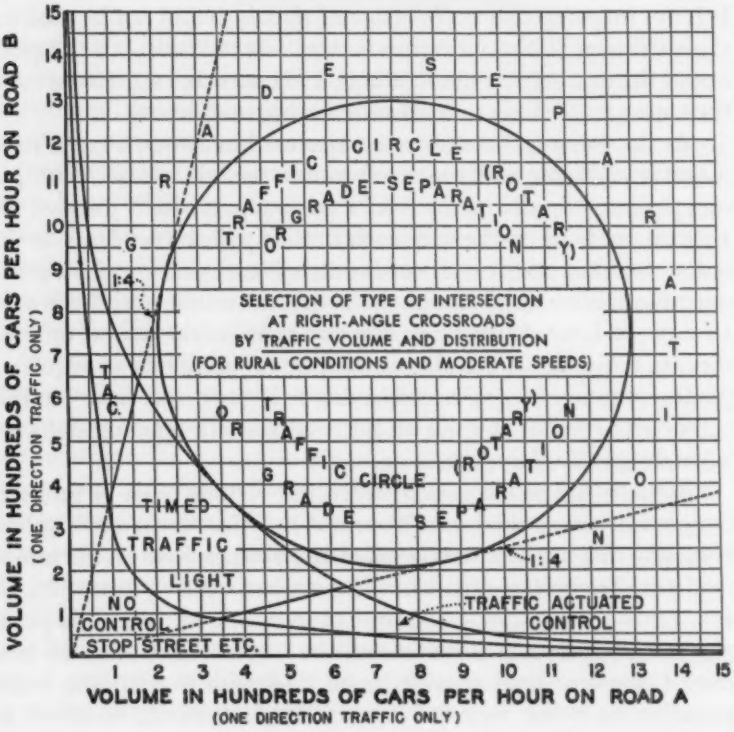
As the volume of traffic on a major road increases, a grade separation is justifiable with lesser volumes on the minor road. With 400 cars per hour on the major road a grade separation is justified for 350 cars per hour on the minor road. With 700 cars per hour on the major road, the minor road needs only 150 cars per hour for a grade separation. With 1,000 cars on the major, the minor road needs only 50 cars per hour. With 1,500 cars per hour on the major, only 30 cars are required on the minor road. It may seem odd to require a grade separation for a side road having only 30 cars per hour but this agrees with present practice on the most modern types of highways when designed as freeways.

Actually the distinction between the various types of intersections can not be as precise as illustrated by a line, as on the diagram. With 550 cars per hour on one road and 210 per hour on the minor road a traffic signal is called for. If there had been 15 more cars, or 225, a grade separation would have been indicated. When the point plots on or near an area line it must be considered as a border line case. These area lines provide broad lines with overlapping interpretation. It is not intended that the diagram should conclude in itself the type of intersection. It is an aid to making this decision. Other things to consider are safety, economic justification, available funds, public attitude, convenience and hazards.

Available Funds a Major Factor

In New Jersey many locations justify improvements but because of the limited funds available only a few most important ones can be improved. This is undoubtedly true in other states too. For this

reason the economic justification is a major factor in the selection whether this fact is acknowledged or not. The individual making the selection depends upon his ability to estimate the cost of construction, the available money and the benefit to the public. The



purpose of standardized criteria is to avoid personalities but as long as the standards are not 100 percent positive, personalities are bound to bear much weight. Therefore the more experienced the selector, the better will be the selection.

Quite often traffic volumes may justify a certain type of improvement but because of the cost, a less expensive type of intersection is tolerated. If it costs $40,000 to provide a traffic signal control at a certain intersection, the installation may be deferred; but if it costs

$2,000 the signals will probably be installed. Likewise, traffic volumes may warrant a grade separation, but if the estimated cost is a million dollars—possible where expansive right-of-way is necessary—the grade separation may be deferred indefinitely. On the other hand, if it could be built for $200,000 there might be a good chance of building it.

Accident experience is a major influence in determining intersection types. It is presumed that any type of intersection selected will be safe but the safety produced is relative, meaning that it is as safe as reasonably possible with funds available or compared to similar types of intersections.

In general a grade separation is much safer than a signal-controlled intersection but in spite of this traffic signals are installed at many locations. The chart is intended for use in selecting the generally accepted standard types of intersections. There are many modifications or variations of the types which are not included.

Some special designs of channelization will prove satisfactory without traffic signals even though the traffic volumes are large enough to justify traffic signals if the channelization were not used. It is possible for a signal-controlled intersection having proper design of channelization to carry much more traffic than a traffic circle. Indeed, properly combining traffic signals and channelization may possibly provide the same service as a grade separation.

This diagram is presented in the hope of simplifying some of our decisions so we can concentrate on the more complex problems of building better highways.

Parking Needs in the Development of Shopping Centers

DAVIS K. JACKSON

Mr. Jackson, a civil engineer, was engaged in engineering promotion up until the war. In 1946 he joined the J. C. Nichols Company and since then has been a member of the Business Property Department where in addition to participating in the management of the Company's eleven shopping centers, he is also responsible for the planning and management of its free parking facilities.

THE J. C. NICHOLS COMPANY of Kansas City, Missouri has been a student of the parking problem for over twenty-five years. The company started developing the Country Club Plaza Shopping Center in 1923 and almost concurrently—in 1925—built two parking lots; one having a capacity of 235 cars and the other a capacity of 155 cars. This was a radical departure from the normal practice at that time, but it has since become widely accepted, and large free parking areas are now generally considered essential for any suburban development. No hard and fast rules can be laid down for parking in a shopping center, but perhaps some basic data or guide points can be generally agreed upon for reference.

Much has been said about the ratio of space for car parking to areas of commercial usage. Such a ratio is probably more accurate if used in terms of the number of cars per 1,000 square feet of floor area. In so doing, it is possible to avoid favorable ratios where the ground used for parking is inefficient and will not develop the number of car spaces that normally might be expected. Likewise, it enables the developer to take into account the on-street parking.

The Urban Land Institute, perhaps the outstanding authority as a group on this subject, considers that 10 car spaces per 1,000 square feet of floor area are about the minimum any developer should plan for. In general this is true but each individual location must be carefully analyzed to determine the amount of bus and street car transportation available between the trade territory and shop-

ping center, the number of potential walk-in customers from apartments in the immediate vicinity, and other factors which would influence the final plan.

The consideration of the number of car spaces required for a certain shopping center or a group of shops is in itself only a part of the problem because there is also the importance of location, size of the individual parking lots, and their physical development.

Small, Well-located Lots

Our feeling, based not only upon our own experience but upon observation is that it is important that parking lots not be too large; particularly the normal open-air, surfaced parking lots. When these are small and well located there is not the serious interruption to the retail continuity of the shops. At the same time it is possible to place free off-street parking in close proximity to each and every shop. This may well be done in large lots if the distance from the farthest parking space to the nearest shop is held down to 300 or 350 feet.

While it is desirable to keep a shopping center compact, it must be remembered that the distance the customer walks from a parking space to a store is perhaps more important than the distance between stores he may be visiting after he parks. The psychological barrier to be overcome in getting a customer to park and get out on the sidewalk is much greater than that involved in getting the customer to go on to another store after visiting the first store.

Normally, a customer only parks once in a suburban shopping center, but the necessity for parking more than once might not be so much the location of the parking lots, if they are convenient, as the location of the shop the individual wishes to visit. Here again the importance of shop grouping becomes apparent. The weak link in merchandising today, which could prevail in outlying areas, is the problem of parking. The tremendous sums spent on advertising to bring people to the shops, the equally important amounts spent on the display of merchandise and the training of personnel are all wasted if the customer cannot park conveniently.

Likewise, small lots, 100 to 200 cars, are particularly attractive to one making a hurried stop, perhaps on the way to and from work,

who will not stay very long and does not wish to spend much time in parking. Large parking lots are undoubtedly more successful around large stores where the customer expects to spend an hour, or even two or three hours, and is willing to take a little more time and trouble to park. In developing a shopping center adequate provisions must be made to hold the average distance the shopper must walk to a minimum. Layout difficulties may be minimized by using show windows and good entrance treatment in both the front and rear of the store. In recent years underground delivery and pick-up of merchandise has been a tremendous step forward toward the relief of many difficulties, including traffic congestion, that confronted earlier developers.

Planning Attractive Layouts

We have beautified our parking lots with masonry walls, vines, flowers, trees, shrubs, and objects of art. Where possible, the parking lot is blended into the development by lowering the level of the parking station two or three feet below the grade of the adjacent street. Thus the top of the cars are below the normal line of vision of the pedestrian on the adjacent sidewalk. This may seem a little elaborate on first thought, but since the development must stand the test of competition for many years, we believe such expense is justified, at least in our own case.

Many cities, including Kansas City, have established ordinances providing for fences of some sort to restrict ingress and egress on the parking lots located in business-zoned areas, dustless surfaces, and adequate lighting. In residential areas it is necessary to place walls or planting around the lot, along with a dustless surface, and lighting when it is used at night. Normally such restrictions are very much in order and contribute greatly to acceptance by the customer.

To relieve congestion in existing shopping centers and preserve tax values, zoning ordinances can be developed that would permit, under certain conditions, the use of adjacent property not necessarily zoned for business for parking facilities. The presence of parking lots in apartment-zoned and residentially-zoned areas is not necessarily objectionable when properly handled with planting, decoration, etc. Many zoning ordinances over the country incorporate such pro-

visions satisfactorily. Certainly under the able management of Kansas City officials results have been gratifying. It is essential in this field to have the leadership of zoning authorities, traffic engineers, and realtors.

Great care must be exercised in the planning of the individual parking layouts. While there is no great difference in diagonal or right-angle parking in parking lots as such, many areas quite suitable for one type will not operate efficiently with the other type. Careful marking of stalls will avoid the inefficiency created by straddling lines. We normally use concrete buttons for this on the right-angle parking and painted lines on the pavement for diagonal. One objection to marking stalls with buttons is the difficulty of efficiently removing snow from such areas. This is a factor to consider in northern climates where snow may be present for many weeks in the winter unless adequately removed.

Concerning possible future enlargement of stall widths, it may be that automobile design has about reached maximum door widths. Even though the newer cars have the hinges on the extreme exterior of the car, perhaps the trouble from that particular feature will not be increased. However as far as the operation of parking stations is concerned, we still have a large percentage of the older cars.

Our company initially used spaces measuring 7 feet 6 inches in width, but we are gradually increasing that, and in parking lots where there is any appreciable turnover, a width of not less than 8 feet will be required. In right-angle parking we use a bay width of not less than 65 feet for our higher turnover stations; on the very highest turnovers, such as those adjacent to cut-rate drug-stores and cash-and-carry groceries, right-angle parking is not recommended at all. Of course the bay width of diagonal parking varies with the angle of parking. We have not experienced any particular difficulty with parking on slopes where the slopes are as much as six percent. In view of the traffic problem, any parking lot with a capacity of over fifty cars should, if possible, have two entrances. While many of these entrances are 20 to 22 feet wide, it is difficult for cars to pass in the entrance because the entering car is usually on an angle. Twenty-five or twenty-six feet would be a minimum width to allow cars to pass easily.

Every effort is made to place entrances to parking lots on the

less important traffic streets. If the parking lots are visible from the high-traffic streets, the entrances are much more satisfactory on the side streets. People have less trouble getting in and out, there is less resistance to that traffic movement in the minds of drivers, and it causes less congestion. Traffic congestion is directly deterimental to a shopping center. Of course everyone wants activity and a great deal of it. It is symptomatic in retail business that the more activity the more attraction there is for other customers.

Careful Location Essential

It is essential to plan shop location with reference to parking lots, and vice versa. Many businesses, such as super-markets and large drug stores, require more parking than other types even though the turnover is very high. Likewise, peak night loads from bowling alleys and recreation developments, including theaters, may blend with the daytime parking load. These problems place a definite responsibility on the developer for a complete study of the proposed shopping center prior to construction.

Since the war there has been a tremendous development in suburban shopping centers with widely varying layouts. The question of the difference in adverstising value between shops immediately adjacent to heavily traveled thoroughfares and shops set back one or two parking bays from the street, will be interesting to watch. So many other local factors may affect a particular center that it is doubtful whether any rule of thumb can be laid down for the best arrangement of facilities. Human nature being what it is, many shoppers will continue to drive around the block several times looking for a curb space rather than go directly across the street from their destination and park in an off-street parking lot. However, the present trend of traffic control seems to point toward increased restrictions on street parking and the resultant increased need for off-street parking.

It must be borne in mind that there is a difference between the number of cars that can be parked in a given area when the cars are handled by the driver and when they are parked by an attendant. Some people feel strongly about turning over a car to an attendant

An open air parking station for 300 cars in Kansas City, Mo., near theater-shopping center.

Triple deck off-street parking for 3,000 cars in Kansas City, Missouri's Plaza shopping center.

because they lack confidence in his handling of it, although of course there are many high-type parking operations in which this complaint would not apply. Synonymous with the philosophy of the development of suburban shopping centers is the idea that the cars be handled and parked by the driver.

There will no doubt be exceptions to this rule, particularly in parking facilities maintained in connection with more expensive eating places and dress shops. The study of any shopping center should include the possibilities of such a development. In this same field the topography of the site should be carefully analyzed for possible ultimate construction of multiple-level parking facilities which may be entered from ground level at various points on the perimeter. This makes for very efficient parking usage and layout as multiple-level structures go, and often contributes to roof-level parking and the consequent advantages from that type parking with escalator service. Some stores have developed roof parking where the ground was absolutely flat and extensive ramps were necessary to reach the roof level.

Large shopping center developments should also provide facilities for parking of employees. In shopping centers of thirty to fifty acres in area, particularly where public transportation is very limited, it may be necessary to handle from 750 to 1,000 cars of all day parker-employees. While these parking facilities can of course be in more remote locations, it will still be necessary to do an excellent public relations job to gain employee-cooperation in getting them to park in the designated areas. This is essential because efforts to provide parking space for your customers will be nullified through the careless parking of employees.

The emphasis on this problem is not the tremendous importance of parking—that is generally accepted—but rather the importance of the careful planning of parking facilities with relation to the overall development, and the intense study necessary for layout and development of the individual parking area. Just as merchants have progressed in planning and modernizing retail stores, we must go forward in modernizing and improving the appeal of our parking facilities so they will be beautiful, accessible, and readily apparent to the shopper.

Support for the Traffic Program

WILBUR S. SMITH

Technical Advisor, The Eno Foundation

PART FOUR

The last of a series begun in January, 1950

THE growth, vitality, and stability of every community bears a close relation to the adequacy of its traffic organization. A good traffic program is necessary, a measure of the progressive community. Its beneficial effect will be an important factor in the future of the city.

To improve present conditions, and to anticipate and plan for future conditions is the primary purpose of a traffic organization. There is probably no such thing, however, as a *best* plan of traffic organization. The effectiveness of any organizational form is measured in terms of its suitability to the particular community. Cities differ, like individuals. Consequently, conditions and influences dictating the traffic program vary.

Too much rigidity in traffic organization interferes with the result because the problem is constantly changing: no problem in modern government is more dynamic than transportation and the conditions it creates. Certain fundamentals prove essential to the traffic organization in every municipality. Economic, political and social forces should create the pressure and develop the energy necessary to support the program.

Community Traffic Functions

Because of the various forms of city government, and the nature of traffic conditions, the general character of the traffic problem requires the establishment of certain official functions. These functions are subject to a variety of horizontal and vertical organizational arrangements in the city government. Developed on a *purpose* basis, and in simplest form they include: 1) Traffic Engineering, 2) Other Engineering (essential to traffic program), 3) Enforcement, 4) Safety

Education, 5) Planning (essential to traffic program), and, 6) Electrical and lighting activities.

Many other functional and organizational units relate to a community's traffic affairs. The legislative body should provide adequate and modern laws. Courts should adjust their methods to special conditions created by traffic offenders; and traffic matters often involve legal problems.

As pointed out in previous articles, traffic responsibilities do not end with municipal government. Many other agencies rightly concern themselves with traffic matters. These include civic associations, professional bodies and business groups. Evaluation of traffic needs of any city will show the necessity for wide participation in any successful program.

One of the principal functions of any municipal government is the proper evaluation and coordination of its functions. Because of their far-reaching effect and their dependence on public acceptance and support, traffic affairs (official and unofficial) can be coordinated through traffic commissions and committees.[1] The entire program requires support—legislative, administrative, judicial and financial —and active public participation. The best traffic organization cannot function effectively unless it receives strong sustained support in line with the aims and abilities of the community.

Legislative Support

Keeping traffic and motor vehicle laws modern is in itself an important legislative responsibility. Increased registrations and vehicle uses; changes in vehicle operating characteristics; improved route facilities; demands of commercial groups; research findings, and other developments should be well understood and legislative bodies should give to them continuous, serious consideration.

The city depends on actions of both its own and state legislative bodies. To develop uniform and reasonable legislation, there is a trend toward increased state control over local traffic affairs. While this trend is opposed by some municipal officials, it is not believed

[1] See article: "Coordinating Local Traffic Activities" TRAFFIC QUARTERLY, p. 326, July 1950.

objectionable from the standpoint of sound city traffic administration and operation, except where the controls are so inflexible as to prevent city authorities from dealing with peculiar or emergency situations.

Many cities depend upon their state legislature for enabling laws in support of major traffic affairs. Uses of parking meters, routing of special types of vehicles, and the control of public carriers; taxes, participation of the city in off-street parking facilities, and construction of certain types of roadways are a few of the areas in which state enabling acts are generally required. Frequently much-needed acts meet opposition. A rurally dominated legislature may be biased in its views on municipal traffic needs.

This has been demonstrated by recent state laws restricting the use of parking meters. It is not uncommon in the state legislature for one city to be opposed by another. Several cases are known where the enabling act sought by a city failed to pass when other cities, particularly politically strong cities, failed to support the measure. This situation is often overcome by enacting a special bill applicable only to the single city or to a class of cities.

Both state and local legislative bodies are subjected to strong lobbying and pressure influences in traffic matters. In the more common legislative cases affecting organization, personnel, budget, and routine traffic regulations, the city legislative bodies must face political and organized group attitudes and policies. These are serious obstacles to sound and progressive traffic development.

A few individuals or a single association may have political strength to strangle traffic programs that would benefit the people and add to the city's well-being. One-way streets are an example. Traffic sometimes becomes a plank in the local political platform. These planks usually are initiated by special interests that fail to consider the general welfare.

In view of these conditions and since all traffic programs depend basically upon legislative action, every effort should be made to gain legislative support. This can be accomplished in several ways. Requests to the legislature should be made with convincing plans well supported by unbiased facts and arguments. Legislatures should be furnished with dependable information for countering requests and

"pressure" actions of special interest groups. The need for progressive, rather than radical, action must be recognized. Traffic limitations and needs, as well as other legislative requirements, must be kept in mind in framing traffic proposals. The importance at the local level for technical and professional traffic services should be demonstrated to all legislative groups.

Administrative Support

It is unfortunate that many key city executives and administrators fail to realize the importance of a sound traffic program. Because of other pressing problems, they may feel that existing activities are adequate, or they may become engrossed in other problems. Such an attitude is difficult to defend. It serves no useful purpose and may aggravate the problem. Traffic activities are so interspersed throughout city departments that it is easy to point to limited or piecemeal actions as indicative of *complete* traffic services. Going to the roots, one is likely to find that administrative neglect is due to an erroneous belief on the part of officials that "all that's necessary" is being done, or that the problem has become so bad as to defy correction.

Some public officials are unaware of what has been learned in recent years in attacking traffic problems. Often they do not accept the fact that technical specialists provide efficiency in traffic as in other areas. They don't realize that many of their most acute problems are peculiar to their city and cannot be corrected by general or by hit-or-miss methods.

Such conditions can be corrected only by showing administrators the correct needs, and by demonstrating contributions that can be expected from the various services and treatments available. In this, local agencies having primary traffic responsibilities must take the lead. The services of state, regional and national groups in many instances may be of assistance.

Financial Support

Like all public activities, the traffic program requires money. As a matter of fact, the funds needed often appear disproportionately

large. This is inevitable in light of the unprecedented increases in highway traffic. Physical facilities are expensive. Urban expressways, for example, cost from one to three million dollars per mile. Routine requirements for "holding the line" are sizeable. If you bring together all expenditures for traffic, small cities as well as large cities develop large totals in relation to other expenses. Nationwide, a major part of every transportation dollar goes into highway transportation.

The cost of providing good traffic facilities and controls is high, but it does not present a one-sided financial picture. The revenues derived from highway users are also large. The American public has demonstrated over and over again that they want good automotive transportation and are willing to pay for it. The high costs to individuals show further that this form of transportation is selected on other than economic bases. In many cases, other forms of transportation would be far less expensive.

Cities have several sources of traffic funds. They include 1) *General taxes* from real estate, business properties, etc.; 2) *state-aid* from highway user revenues collected by the state; 3) *federal aid* allocated by the federal highway acts and disbursed through state highway departments; 4) *local highway user taxes* which might be derived from local fuel taxes and registration fees; and 5) *parking meter receipts*. In spite of this wide variety of sources, all cities are sorely pressed for funds to support traffic improvements and programs.

It appears that highway transportation has become so thoroughly integrated into the over-all life of the nation that revenues other than those derived directly from highway users should be appropriated to highway needs. In many cities, the reverse is true: sizeable amounts of the highway revenues are used to finance other governmental activities. Most highway taxes accrue to the state so that cities do not have the same relative opportunity to divert them. In cities it is common to find highway user funds, such as those derived from parking meters, used for general fiscal purposes. Some officials are inclined to neglect traffic needs for other urban needs when the pinch is tight. On the other hand, cities usually are forced to maintain a substantial part of their total traffic obligations from the

general funds. Many street improvements, for example, are financed largely from property taxes or special levies against property owners.

There is much jockeying and manipulation of highway funds. One group wants highway revenue for non-highway purposes while another attempts to show that all highway taxes do not produce sufficient revenue to meet automotive transportation needs, especially in cities. Perhaps we have reached the point where money derived from highway users should go into the general funds of various government units collecting them.

Such a plan would be in keeping with recommendations of most experts in public administration and with the general practices of the Federal Government. Taking the highway side, the plan would work only after public officials developed a realization of the importance of automotive transportation to the welfare of every political subdivision. This requirement is far from realization. As a result, it is doubtful that the suggested plan of pooling all highway user revenues with other funds is advisable in the immediate future for it might lead to a greater diversion of highway revenues.

Public Support

Much information is available on methods of developing public support. No attempt is made to review here the fundamental techniques of public relations, but it should be obvious to all those in public service that support of the public is necessary to successful and lasting endeavors. Several conditions and objectives are essential to this attainment in traffic.

Democratic approach: A more democratic approach to driver and pedestrian control is needed. Traffic bears directly on most of the desires of man: preservation of self and family; maintenance of high living standards; and, social and aesthetic demands. *Man* must be accepted as a component with which to deal in the traffic problem and not as a factor to be basically changed. Every individual wants to enjoy the same respect and opportunities as his fellow citizens. He wants a chance to do what's correct. He is willing to do it in a cooperative way.

It bears repeating that "Most people want to do what's right and

they want to be safe." More thought should be given to dealing with the human being rather than to restricting and eliminating him as a factor in traffic—especially in accidents. Suppose we effectively eliminated the top 5 per cent of the accident-prone drivers. Next year there would be another 5 per cent, and so on to the removing from a large majority the privilege to drive. Removal of the obviously unfit drivers is necessary, but arbitrary actions in denying driving privileges to certain groups appears unrealistic. At the same time it should be remembered that individuals are anxious to apply self-discipline, when they know what's best and correct. They will listen to reason and they can be taught.

Undesirable actions and activities often are easier to define than many desirable behaviors, so it is natural that negation and prohibitions develop in government control of traffic. Public cooperation cannot be expected in the traffic program unless officials *work with*, rather than *against* drivers. Most regulations cannot be enforced on people but must be accepted by them.

Adequate Information: When the majority of road users fail to act properly, there is usually evidence of ignorance, improper, or unwarranted controls. New regulations and technical innovations cannot obtain public favor unless their meaning and their purpose are understood by the public. Sometimes an excellent traffic plan meets with public disfavor because an opposition group has more to say against it than officials say in its favor. A modest ban on curb parking, which would benefit a majority of motorists, in a city, might fail because of objections voiced by a few selfish merchants. The public never fully realizes the benefits.

Keeping the public informed is as important to the traffic expert and to public officials as knowing what should be done about traffic problems.

There are still too many cases in which traffic officials completely overlook desires of the motoring public. Recently one of the nation's most heavily traveled highways was thrown into a chaotic condition because of the improper planning or execution of a plan to paint center and lane lines. Long delays were incurred by motorists and traffic was backed up for a distance of over three miles. From a public relations point of view the situation was made even worse because

each of the "restricting signs" located along the section bore the words STATE ROADS COMMISSION. A cooperative public attitude cannot develop from such conditions.

Public support of the community's traffic program is directly dependent upon whether or not its component parts appear reasonably progressive. It is safe to say that more public opposition has been derived from over-restrictive and obviously unreasonable regulations than from any other cause. In spite of this, many communities still apply stupid traffic regulations and controls.

As in all areas of life, there will be some who must be restricted and penalized. In traffic it is a small minority. Developing enough restrictions, but avoiding over-restriction—let us say the optimum restriction—is a major challenge to traffic and other public officials. It is the keystone of public support.

If a good public relations program is to be achieved, it is important that proper public consideration permeate the entire traffic organization, from top officials down.

Progressive Correctives: The dynamic nature and rapid growth of traffic demand alert and progressive actions. What's adequate today is apt to be obsolete tomorrow. A single traffic survey, or a major physical improvement, or a revised code, or an increased enforcement strength, or establishment of a traffic engineering department, or any other action will not satisfy the traffic needs of any city for a long time. Frequently this is not realized; probably because its realization necessitates sustained action of a vigorous type. Failure to acknowledge and meet continuing needs will inevitably bring about conditions which will destroy or greatly weaken public support.

Other Support

Other local groups must support the traffic program if it is to progress and achieve stability: various civic organizations, local chamber of commerce, merchant's association, and press.

The support of civic organizations, such as the service clubs, is usually easy to attain. Care must be exercised, however, to see that support is along desirable lines. This means that the civic groups must be carefully coached and advised as to what are the legitimate

traffic needs and requirements of the community. Members of these associations are usually quite public-spirited and are anxious to support the community needs, but they are not, as a rule, traffic specialists nor do they have much time to devote to a study of traffic conditions.

It cannot be assumed that they are in a position to decide what is, or is not, good for the traffic program. It becomes the responsibility of traffic officials to help them direct their efforts in support of the city's traffic work in the right direction. Even though well intended, misguided activities of such groups can do the overall program considerable harm, rather than the good intended.

The chamber of commerce naturally represents the thinking of business groups. In many cities they can mold correct attitudes among their member organizations for the traffic work of the community. It is largely a case of who controls or most strongly influences their actions. Will the Chamber develop an unbiased attitude on traffic, or will it yield to the wishes of its members whether such wishes are right or wrong?

Business, on the whole, is not inclined to take chances with traffic changes. "Leave things alone" is too often the slogan even though congestion is chronic! Basic traffic regulations are often resisted by business groups, even though the regulations provide traffic relief, which is essential to stability of the downtown areas. Fortunately, such attitudes do not exist in all cities and with all influential business groups. Some are progressive and realize the importance of good traffic control and the values growing out of development of both routes and terminals.

Getting the whole group of merchants to support the overall program, not arbitrarily resist changes, is the objective. This necessitates development of an attitude that traffic improvements should be made on the basis of "community betterment." In some instances this may penalize a few individuals, but unless merchants understand that proposed correctives are for community betterment, they are apt not to support as a body the needs of the city and the recommendations of public officials.

The power of the press is as real in traffic as in any other public activity. Even the best programs would fail if the newspapers were

persistently adverse. An uninformed or biased press would create public opposition to the soundest traffic treatments.

An adverse press can result from personalities, political influences, and failure to understand key aspects of traffic needs and treatments. A newspaper editor or publisher might object to the creation of a special traffic agency or to some other official traffic endeavor. There might be personal objections to some one appointed to a traffic position. Cases have arisen wherein a general disagreement between the press and the city administration (political or otherwise) resulted in consistent opposition in the newspapers to most official traffic activities; not because of the particular activity, but because it was a part of the administration's actions.

Fortunately these are exceptional conditions. The press is usually progressive and gives whole-hearted support to traffic affairs. When an unwise action is advocated, or when opposition is registered, it is probably due to a misunderstanding of traffic conditions or proposed correctives.

An informed press will support sound traffic needs. Sometimes strong press support can be achieved by yielding in a traffic treatment to the wishes of an editor—provided it does not involve unsound controls or expenditures. Often a key person on a newspaper staff will have a pet traffic project.

When the project is legitimate, prompt attention to it by city officials can result in both current and later press support of sound traffic proposals.

It is not to be inferred that the press should support every idea or proposal of officials relative to traffic. Local officials can make mistakes! Traffic authorities, including the experts, are subject to all the failings common to other public officials. They may think their budget needs more important than any others; they may want too much independence. They can develop an inflated idea of their values, and they may fail to act upon valid criticism.

Specialists cannot be left to run the show alone. The press can render a much needed public service by opposing unsound, overrestrictive, and uneconomical propositions.

Support must be programmed. A long-range plan of operation

and growth is essential. It involves forecasting needs based on problems.

Knowing what to do will not in itself solve the traffic problems of any city. Sustained support of properly developed, administered, and co-ordinated programs is required of the entire community. A two-way affair develops: Good traffic work generates community support, and community support makes good traffic work possible.

Off-Street Parking and Loading in Miami

EARL J. REEDER

Mr. Reeder is a traffic and transportation engineer for an engineering firm in Miami, Florida. From 1946 to 1950 he was Director of Traffic and Transportation for the city of Miami, in charge of the city's traffic and transportation engineering program. During 1945 he was Chief of the Public Safety Section of the Manhattan District Project at Oak Ridge, Tennessee. For twenty-two years prior to that he served in all grades from engineer to chief traffic engineer for the National Safety Council in Chicago, and served as consultant on traffic and safety problems for many cities. Mr. Reeder is a civil engineer, a member of the American Society of Civil Engineers, a director of ITE, and an Associate of the Highway Research Board. He was a contributing editor for the Traffic Engineering Handbook, 1941 edition.

MIAMI, like other cities, has been struggling with parking and loading problems for the last several years. Traffic has increased more than 50 per cent in three years with a corresponding need for parking and loading facilities. The only means of taking care of traffic and parking demands increasing at such a rate on the same streets as before has been through restriction and more restriction.

In an attempt to keep the parking and loading problem from becoming intolerable, or from solving itself by a ruinous rate of business decentralization and redistribution, the city passed an ordinance, effective last July, prescribing requirements for off-street parking and loading facilities for new buildings. Some interesting lessons emerge from the five years between the initial consideration of this bill and its final passage.

Officials and commercial interests in Miami have long recognized that off-street parking must supersede curb parking as more street space is required for moving traffic. However, the question of how to accomplish the change called forth great variety of opinion.

Off-Street Parking Plans Varied

One group believed that the city should provide parking lots and/or garages and either operate them itself or allow them to be operated on lease by private business. Another held that builders should provide their own facilities.

One major difficulty with the city's providing off-street facilities as the only solution, was that with no assurance of the proper relation between parking requirements and facilities, these could be constantly out of balance. For example, it was conceivable that a new parking lot in a business district would attract additional building in the area and thus continue the problem the lot was designed to relieve. Without some type of control, the problem could pyramid indefinitely—more building, more parking facilities, more building in turn, and so on.

On the other hand, requiring builders to provide their own parking and loading facilities would eventually create an automatic balance between the demand generated and the facilities provided. It would not be permissible to build a large generator of parking demand in an area where the necessary facilities could not be provided. The demand and the supply would grow together, if the proper restrictions were applied.

Many progressive business firms now provide their own parking and loading facilities not only for new buildings but in many cases for older ones. However, such independent action may be neither sufficient nor dependable. Furthermore, less progressive builders, who do not foresee the developing problem or do not feel the obligation to prevent it because of expected brief ownership of buildings, can fail to do their part and make difficult the access to facilities that are provided. They must be brought to conform with requirements through regulation and compulsion.

It must be recognized that off-street parking and loading facilities for new buildings cannot solve the immediate problem but are designed to arrest further development of the same conditions. The present problem will doubtless have to be solved by providing publicly owned facilities on a self-liquidating basis.

First Ordinance Failed

Zoning requirements for parking and loading facilities for new buildings in proportion to the demands they generate had been considered, but it was not until 1946 that an ordinance was prepared and submitted to the City Commission. This was modeled largely upon the Los Angeles ordinance which had gone into effect some time before. It differed from that ordinance, however, in exempting the central business district from the requirements.

It developed that Miami was not yet ready for such legislation. The regulations were not adequately understood. Many thought that they applied to present buildings as well as future ones. Others thought that parking facilities would have to be provided on the same property with the building. Still others contended that the regulations would impose serious hardships on certain lot sizes. It was not yet possible to combat all of this opposition and the ordinance failed to pass.

However, the effort was not a total loss. The work of preparing the ordinance, discussing it with various groups, and presenting it to the City Commission, created wide public interest and stimulated voluntary action on the part of builders. As a result, many adequate parking lots and loading facilities have been provided voluntarily by the builders of new buildings—commercial buildings in particular.

Piece-meal Law Defeated in 1947

In the spring of 1947 an effort was made to pass an ordinance requiring off-street parking for only new houses and apartments, and exempting commercial and other types. Some felt that the problem could be attacked piece-meal in this way and that later the restrictions could be extended to other types of new buildings. The requirements for these residential buildings would be similar to those in the initial ordinance in 1946.

Again, the ordinance was defeated; this time, largely on claims of discrimination and confiscation. The opponents contended that since this requirement applied only to residential buildings, it was not getting at the areas where the greatest parking and loading prob-

lems occurred—in the business districts. It became obvious from this effort that the best way to approach this legislation would be to make the restrictions apply to all kinds of new buildings in which parking and/or loading were factors and to attack the entire problem at one time.

Building continued in Miami. The 1947 effort to pass the proposed legislation, even on the limited scale, stimulated more acceptance of the importance of providing off-street parking and loading facilities for new buildings, and more builders decided to provide these safeguards. However, some nonprogressive ones, who did not foresee the great and serious problem surrounding them already, continued to build without such facilities and depended upon the streets to provide their parking and loading space.

Late in 1949, after seriously considering the proposed legislation in the light of past experience, authorities drafted a new ordinance based on a composite of the ordinances of several other cities.[1] These were selected and modified as seemed desirable for adapting to local conditions in Miami.

Space Requirements of New Law

For one-family residences and duplexes, one parking space was required for each dwelling unit. For apartments, one space was required for each dwelling unit up to and including 20 and one space for each two-dwelling units over 20.

For hotels, apartment hotels, and clubs, one space was required for each of the first 20 individual guest rooms; one space for each 4 rooms in excess of 20, and not exceeding 40; and one space for each 6 rooms in excess of 40.

Tourist courts were required to have one space for each sleeping or living unit.

High schools, colleges, and similar institutions, auditoriums, theatres, stadiums, and other similar places of assembly, and restaurants and public dining rooms were required to have one space for each 5 seats.

Office buildings, hospitals, clinics, and welfare institutions

[1] "Zoning Applied to Parking," published by the Eno Foundation, was used extensively to establish the table of parking and loading requirements.

having less than 3,000 square feet of floor area, and mortuaries were required to have a minimum of 6 parking spaces. Similar buildings having more than 3,000 square feet of floor area were required to have 6 spaces plus one for each 1,000 square feet of floor area in excess of 3,000.

Retail, commercial, and business uses of buildings must have one space for every 1,000 usable square feet of floor area in excess of 5,000. Wholesale uses are required to have one space for every 2,000 square feet of floor area in excess of 5,000.

The parking spaces for one-family residences, duplexes, and tourist courts must be on the same premises with the buildings. Those for other buildings may be either on the premises or within 500 feet from them. In every case, parking spaces must be provided permanently and must be exclusively allocated to individual buildings.

Two or more buildings may use a parking facility together but the available capacity must equal or exceed the combined requirements of all users and the required capacity must not be allocated to any other use. If parking spaces are not shown by actual plan and count in an application for a building permit, 300 square feet of gross area per parking space are to be used in determining the capacity requirements.

The ordinance also required that new buildings, used for certain specified purposes, shall have off-street loading facilities. It specified that any building or structure erected and occupied for "manufacturing, storage, warehouse, goods display, department store, wholesale store, market, hotel, hospital, mortuary, laundry, dry cleaning, or other uses similarly involving the receipt or distribution, by vehicles, of materials or merchandise" shall have on the property adequate space for standing, loading, and unloading of vehicles to avoid interference with the public use of streets or alleys.

Unless otherwise provided, such spaces must include space of a minimum of 10 feet x 25 feet and 14 feet in height for every 20,000 square feet or fraction thereof in excess of 5,000 square feet of building floor space used for any of these purposes. The same provision applies for every 20,000 square feet or fraction thereof in excess of 7,000 square feet of land used for such purposes.

Because the central business district of Miami is completely built

up, the off-street parking and loading requirements could not reasonably apply to this area and the central business district was exempted from all of these provisions. However, in that area application of the city's authority to own and operate off-street parking facilities is seriously considered. These probably will be financed on a self-liquidating basis with perhaps an initial assessment against the benefited properties to cover a part of the land cost.

Problems in Applying Ordinance

The ordinance passed second reading on June 7, 1950 and became effective thirty days later. As in all new legislation, problems of applying it are being encountered, especially during the period of transition from the former unregulated building without parking and loading space requirements to the new period requiring such facilities. Three major problems of applying the ordinance have been experienced.

The first deals with buildings for which permits had been issued before the ordinance became effective but on which construction had not been started. It was obvious that builders could not be required to revise their plans which had already been approved, to make them conform with an ordinance that became effective later. Similarly, plans that had been practically completed but not approved for the issuance of building permits could not be modified in some cases to meet the new ordinance without undue hardship. Hence, some variances were necessary to meet such situations.

Another problem has been to acquaint the public with the importance of the ordinance requirements for off-street parking and loading facilities and the need for maintaining these facilities in perpetuity. They have had to be shown that once a parking lot or garage or loading facility has been provided in accordance with the ordinance, it must be continued in that use so long as the building that it serves is used for the purpose for which it was constructed or altered.

A third problem deals with special applications of the ordinance necessary to fit unusual cases. For example, sometimes a proposed building for which the required total of off-street parking spaces may

not be readily available will be devoted to a use that will not need parking facilities simultaneously with others in the immediate vicinity. Such a case requires judgment between strictly following the ordinance regardless of results and varying from the letter of the regulations to fit one particular instance.

Thus, the ordinance may have to be adjusted to meet unforeseen conditions where such adjustments will not defeat the purpose of the ordinance. But as time goes on, property owners and builders who have not been affected by these special cases will recognize the value of the regulations and adjust their building plans and programs to conform.

Six Lessons from Miami

The Miami experience during the five years between the first effort to pass the legislation and its eventual enactment, taught some very definite lessons, discussed briefly here:

1. Fix clearly in the public mind that the restrictions apply to *new* buildings and not to *existing* ones. In the first effort to pass the ordinance, confusion about this point caused many people to think that if the ordinance were passed, they would have to provide the parking and loading facilities for existing structures. In many cases this would have been impracticable and this feeling undoubtedly helped to defeat that ordinance. It should be clear that restrictions apply only to new buildings and to future alterations of existing ones, and do not affect present buildings unless so altered.

2. As far as possible, impose equivalent requirements upon different types of buildings and in different areas. If one area is exempted from the off-street parking and loading requirements for new buildings, it must be immediately clear that *other* requirements are being imposed so that property owners in that area have an obligation equivalent to those in other areas. For example, in a central business district already largely built up, an arrangement to provide parking facilities by benefit district taxation can be construed as an equivalent obligation on the part of builders and property owners in that district. Failure to show equivalent obligations of some type is apt to defeat the desired ordinance through claims of discrimination and confiscation of property.

3. Provide for possible joint use of facilities for parking and/or loading by adjoining properties. This means, of course, that the total capacity of the facilities used jointly must equal the total requirements of all users. An advantage of such a provision is that larger areas usually afford more efficient space for parking and loading than smaller areas. Also, a large area may require fewer entrances and exits and hence interfere less with both vehicular and pedestrian traffic on the streets.

4. Make the provision of required parking and loading facilities a continuing obligation. Otherwise, pieces of property shown as parking or loading facilities may be diverted to other uses after building permits are obtained, and the purpose of the ordinance will thus be defeated. The approved parking and loading facilities should be maintained as long as the building is used for the purpose approved for its occupancy. When any change in use is proposed, the parking and loading requirements should be reviewed to determine new ones depending on the building's new use.

5. Combat the "discrimination" and "confiscation" claims that will be made by certain opponents of this type of legislation. The most common of these claims come from owners of small pieces of property who contend that their inability to construct the desired building and provide off-street parking and loading requirements will amount to confiscation of their property. Of course, this is partly combated by exempting properties below certain areas from the requirements. However, this does not apply to larger pieces of property on which the owners want to build as large structures as possible without giving proper thought to the need for parking and loading.

6. Make very clear the requirement that *loading* spaces must be provided in or adjacent to a proposed building, and the requirement that *parking* spaces shall be within some given distance from it. Builders often do not understand that these are two distinctly different requirements, and that the parking facilities may be away from the building itself. It should be made clear that the ordinance is not so much concerned with just where the parking spaces may be located as with the fact that they are provided as an addition to the existing parking facilities in the immediate area. It is particularly important to understand this when the legislation is being con-

sidered, to combat the frequent argument that certain properties will not have adequate space for both building and parking requirements.

These are some of the major lessons from Miami's experience with legislation of this type. Whether the present ordinance will survive without some modification is as yet uncertain. However, the valid reason for enacting it cannot be questioned. We must not allow our cities to continue building without planning for future requirements, and thus perpetuate the problems that have already become seriously acute.

City-owned and -operated off-street parking facilities have an important part to play in correcting the difficulties that already face us. But they cannot continue to correct those difficulties if no restriction is imposed on the construction of parking generators to keep them in proportion to the facilities now available or to be made available when properties are developed in the future.

Pennsylvania's Road Program

S. P. LONGSTREET

Mr. Longstreet, Chief Engineer of the State Highway and Bridge Authority, came to his post with a background of 38 years' experience in building and maintaining highways. He joined the Pennsylvania Department of Highways in 1911 as a rodman, and rose to the office of District Engineer. This he relinquished in 1949 to head the engineering end of the Highway and Bridge Authority. As District Engineer he was in charge of the design and construction of new roads in his area, including one of Pennsylvania's first four-lane divided highways.

LIKE ALL states from the Atlantic to the Pacific, Pennsylvania suspended highway construction during World War II, although the attrition of time and traffic continued on existing highways despite gasoline-and-tire shortages. Hardly a section of this state was without its traffic bottlenecks—and an active local interest demanding their elimination by new and wide highways or more bridges. Rural areas too were seeking better farm-to-market roads, even in the most remote sections.

Governor James H. Duff and his highway planners saw at once that the only solution to the problem was to build, repair and expand roads. Despite some demands that the state go slow and wait for lower prices, the highway building program was put into high gear from the beginning of the Duff administration early in 1947.

To finance this program, the Commonwealth had millions of dollars in surplus funds accumulated in the state's motor fund when roads could not be built during the war. These funds along with current revenues from the gasoline tax and automobile licenses permitted a maximum program of road building consonant with good construction.

Supplementing and paralleling this program was the activating of long-range plans for extending the Pennsylvania Turnpike from border to border of the Commonwealth. This work was to be financed out of the tolls paid by users of this highly specialized highway artery.

The original Turnpike, extending 160 miles between Irwin, near Pittsburgh, and Middlesex, near Harrisburg, was completed immediately before America entered World War II. It had proved itself a going concern, even when gasoline and tire rationing kept all but a minimum of passenger vehicles off the low-grade, four-lane concrete thoroughfare that conquered the Alleghenies by tunneling the mountains instead of going over them.

With such a record, it was easy to convince bankers that the loan of new millions to extend this world-famed highway east and west was a good investment.

Even with this vast road building program in high gear, it was apparent that it would not be enough. Wider and safer highways were still needed everywhere; roads and bridges that had not previously been traffic bottlenecks became badly congested as more and more new car owners used the highways. As traffic swelled without any sign of let-up, it also became apparent that available funds and those in prospect would never do the job.

More Funds Needed

The choice was laid before the public very frankly by the administration. Either gasoline taxes must be increased or the road building program curtailed. As an alternative, it also was proposed that part of the burden of financing new highway and bridge construction be turned over to an Authority whose obligations would be liquidated through rentals collected from the Commonwealth. The public, well aware of the need for roads and the cost of building them, accepted the increase of one cent per gallon gasoline tax against the opposition of some special groups.

Before the gasoline tax increase in 1949, the Commonwealth was collecting four cents on every gallon of gasoline sold. But only a portion of the revenue produced was available for road construction by the state.

The legislature appropriates one half cent of the gasoline tax to counties each year. In 1950, this amounted to more than $10,000,000. It has appropriated $5,000,000 annually to townships of the second class through Pennsylvania; another $5,000,000 each year to cities,

boroughs and townships of the first class. The motor fund also is obligated to pay the expenses of highway safety law enforcement, including a major share of the cost of operating the Pennsylvania State Police.

The tax increase of one cent effective only for two years unless continued by the Pennsylvania General Assembly, was estimated to produce $40,000,000 in revenue in a two-year period. To provide funds that another cent per gallon in gasoline tax would have brought in, the General Assembly created the State Highway and Bridge Authority with power to borrow up to $40,000,000 to build roads and bridges.

Three Pennsylvania Authorities

Creation of this Authority was a unique approach to the highway construction problem. Like other states, Pennsylvania previously had borrowed money under bond issues to build roads, but it was the first time anywhere that road building was put on lease and rental basis.

The Commonwealth of Pennsylvania has three Authorities; each was created by the General Assembly to do a specific job. The largest of these new agencies is the General State Authority, which carries out the building requirements of all State agencies except the Department of Highways. It has the power to build roads and bridges, but has decided as a matter of policy not to engage in such projects.

The second Authority is the State Public School Building Authority, created to help local school districts finance the building of new schools. The third is the State Highway and Bridge Authority, previously mentioned.

The General State Authority and the State Highway and Bridge Authority function closely together. With one exception, the Highway and Bridge Authority technical staff is identical with that of the General State Authority. Both agencies have the same Executive Director, the same General Counsel, the same Comptroller, Treasurer and other officers. Only the Chief Engineer of the Highway and Bridge Authority is completely divorced from the activities of the General State Authority.

The two agencies also use the same offices, draw up their contracts along parallel lines and have carried out their financing on the same general pattern. One great difference between the two agencies is that General State Authority has its own staff down to the last messenger boy, while the Highway and Bridge Authority depends largely on the personnel of the Department of Highways to carry out its functions.

The Highway Department does everything from securing right-of-way through traffic surveys, design, engineering, laboratory and inspection to final completion of the project. One of its district engineers is on loan to the Authority as its Chief Engineer.

How Each Authority Works

On the other hand, the Public School Authority, whose customers are local school districts, functions separately from the other Authorities. Its administration costs are borne by appropriations from the General Assembly instead of by the money it borrows. It has carried out its financing through agreements with various custodial funds of the Commonwealth instead of going into the open market to sell its bonds.

The essential idea behind all these Authorities is rental. These rents are what makes the wheels go around. More accurately, they are pledges the Commonwealth makes that it will pay the rents collected on completed highways and bridges, and are calculated so that they will pay all the construction costs in a definite term of years. The law authorizes leases continuing up to a maximum of 30 years.

Organized in May of 1949, the State Highway and Bridge Authority was requested by the Pennsylvania Department of Highways to undertake construction of roads estimated to cost $39,989,741. These projects were approved and the Authority and the Commonwealth signed agreements providing in effect that the Commonwealth would lease the completed roads and bridges at rentals sufficient to pay all the costs involved.

Costs were spelled out in advance as actual charges for construction, design and inspection, and interest on borrowed funds. The bankers also required the Authority to put aside as a reserve, before

any work was started, an amount equal to 10 per cent of the estimated cost of each project to be used for any contingencies which might develop during construction. This provision assured that the Authority would not have an uncompleted project on its hands and no more power to borrow.

Up to this point, the Authority was without a penny. It began without any appropriation or loan from the Commonwealth and only the authorization to borrow up to $40,000,000. The arrangement with the General State Authority for joint use of the same services carried it over initial stages until it received its first cash from the sale of bonds.

These first bonds, an issue of $15,000,000 principal amount of Series of 1949, were marketed at public sale on December 1, 1949. The issue was sold to an underwriting group at a net price of $14,935,080. The interest rate on $4,860,000 of the issue is one per cent and on the remainder of the $15,000,000, one and a quarter per cent.

The first $1,610,000 in these bonds fall due on December 15, 1953, and the last $1,725,000 on December 15, 1961. Rentals, pledged in advance to pay off these bonds, are due on September 15 of each year. However, none of the twenty-two projects approved by the Authority will be completed before June 30, 1951, so that initially, interest charges on the bonds must be defrayed from the proceeds of the bonds. The first interest, due on June 15 of last year, amounted to $87,675 but was offset in part by interest on investments, amounting to $67,236 received or accrued.

Virtually all the proceeds of the $15,000,000 in 1949 Series bonds were re-invested in government securities, paced to mature as contracts for construction are fulfilled. Up to September 1, 1950, these payments amounted to $2,274,000 while administration costs totaled $65,890. Most of the latter, however, represented costs of financing.

The one per cent and one and a half per cent interest rate on the State Highway and Bridge Authority bonds is believed to be one of the lowest, if not the very lowest for this type bond in the United States. It compares with the 2.30 per cent rate on the recent issue of

$14,500,000 revenue bonds by the Delaware River Joint Toll Bridge Commission for building a new bridge and a new approach to an existing bridge across the Delaware River.

22 Highway and Bridge Projects

The twenty-two highway and bridge projects approved by the Authority formed part of the over-all highway construction program of the Commonwealth and were planned and designed by the Pennsylvania Department of Highways without expense to the Authority. This policy has kept administration costs of the Authority to the lowest possible level and has eliminated any necessity for setting up a duplicating agency to carry out the Authority's functions.

The Authority is controlled by a board composed of the Governor, State Treasurer, Auditor General, and Secretary of Internal Affairs, all elected officials; of the Speaker of the Pennsylvania House of Representatives, the President Pro Tempore of the Pennsylvania Senate, the Secretary of Highways, and the legislative leaders of the Minority Party. These persons are members of the board under the law creating the Authority. The other three members are appointed, one each by the Governor, the Speaker of the House, and the President of the Senate.

The board elected its own officers with Governor James H. Duff as President, Ray F. Smock, State Secretary of Highways as Vice President and Secretary; and State Senator M. Harvey Taylor, President Pro Tempore of the Senate, as Treasurer. Its by-laws place all policy decisions in the hands of the board, whose membership represents a complete cross-section of the executive and legislative branches of the Commonwealth government.

The first projects, approved by the State Highway and Bridge Authority on July 14, 1949, and the last on August 9, 1949, are urgently needed bridges or highways of major importance and their completion will go a long way toward alleviating traffic congestion in important Pennsylvania centers of population.

The bridges are a new free bridge over the Susquehanna River at Harrisburg, linking Mauch Chunk and East Mauch Chunk in Car-

bon County; and the superstructure and approaches of the Belle Vernon Bridge over the Monongahela River in Washington, Westmoreland and Fayette Counties.

The new highways are the portion of the Penn-Lincoln Parkway in Allegheny County from Banksville Circle in Pittsburgh to the Steubenville Pike; the four-lane Schuylkill Expressway from King of Prussia, the eastern terminal of the Philadelphia Extension of the Turnpike, to the city line of Philadelphia; reconstruction of Traffic Route 422 in Lawrence County from New Castle eastward to the Butler County line; the Pottsville By-Pass completion in Schuylkill County; and the relocation of State Highway Route 86, Traffic Route 20, from Springfield to Girard in Erie County.

The bridges are each a project, while the highway construction work, in each case, was divided into a number of projects so that rent could be collected by the Authority on the various parts before the entire job is completed. By September 1, all the projects were under construction except portions of the Penn-Lincoln Parkway in Allegheny County and the Schuylkill Expressway outside of Philadelphia. The contracts on September 1 amounted to $21,823,000, including two projects on which half the cost of construction will be paid from Federal funds.

All the projects approved so far will be completed by January 1, 1953, barring unforeseen developments. Once completed and under lease to the Commonwealth, the roads and bridges remain the property of the Authority until the rentals liquidate the costs, or the outstanding bonds of the Authority are redeemed.

The Authority marketed its bonds under a resolution setting up a procedure whereby the bonds can be redeemed prior to maturity, starting December 15, 1952. This feature was provided because the Pennsylvania General Assembly approved for the first time a proposed constitutional amendment to permit the state to issue Commonwealth bonds up to $40,000,000 to cancel obligations of the agency. The proposal requires similar approval by the 1951 General Assembly and by the electorate of the state in the succeeding general election before the amendment can become effective.

Should the General Assembly and the voters choose to exchange the Authority obligations for Commonwealth bonds through this

constitutional amendment, the redemption of the bonds would immediately result in the cancellation of any leases then in existence between the Authority and the Commonwealth.

Meanwhile the Pennsylvania Department of Highways is proceeding with a construction program that will approximate $113,600,000 this year, the third consecutive year in which more than $100,000,000 has been expended on this account.

During this administration the amount of money being expended for construction, reconstruction, and resurfacing is 88.9 per cent of the combined total spent for such purposes during the sixteen preceding years. This year's record state highway construction program is four times as great as the annual average between 1930 and 1947.

The four-year total of 6500 miles of improvements on state highways, the State Highway and Bridge Authority construction and the extensions to the Pennsylvania Turnpike combine to place Pennsylvania far to the forefront in new post-war transportation facilities.

Uniform Traffic Laws and Ordinances

C. W. STARK

Mr. Stark is full-time Secretary of the National Committee on Uniform Traffic Laws and Ordinances at Washington, D. C. He was previously Assistant Manager of the Transportation and Communication Department of the United States Chamber of Commerce. He was an active participant of the work of the National Conference of Street and Highway Safety throughout its existence from 1924 to 1947. He has also been a member and editor since 1933 of the Joint Committee on Uniform Traffic Control Devices.

UNIFORMITY in traffic laws and ordinances is recognized as a "must" by all who have seriously considered a program for orderly and safe conduct of highway traffic. Looking backward, we can see that great advances toward uniformity have been made in the last twenty years. Looking at present conditions, we see that we are still a long way from our goal.

Uniform rules of the road are a foremost need. Differences in right-of-way, turning and passing rules, and variations in the meaning of traffic signals and stop signs invite accidents. Differences in speed restrictions and the many other operating rules lead to confusion, congestion, and arrests. And because small differences—with intent probably the same—result in differences in legal effect, the President's Highway Safety Conference urges verbatim conformity with the Uniform Vehicle Code in these matters.

Variations in lighting and other equipment requirements and in vehicle size and weight limits are annoyances to operators of private automobiles and may work serious economic hardship on operators of commercial vehicles unable to use the same vehicles with the same equipment in all states where they operate.

Act V—Regulating Traffic on Highways—most comprehensive and important of the five acts of the Uniform Code, contains all of these rules of the road and equipment requirements. These are things the individual driver and the employer of drivers need to know.

Uniform driver-license standards are highly important. These include (1) the age limits and means of determining by examination and road test the fitness of an applicant for a license, and (2) the disciplinary control of the license holder through reexamination, suspension and revocation. All of this has been carefully worked out in Act II—the Motor Vehicle Operators' and Chauffeurs' License Act. The exact language is not vital, but all of the substance should be regarded as essential.

Obviously, to administer the motor vehicle laws there must be adequate organization. Act I provides a pattern for such organization. It also covers registration of motor vehicles, offers a model for certificates-of-title legislation and includes antitheft safeguards. Here again the substance is the important thing. Each state will presumably adapt the organization features to its particular needs.

Act III—Civil Liability, and Act IV—Financial Responsibility—round out the legislative program.

History of Uniform Code and Model Ordinance

The desirability of uniform traffic regulations was perceived as early as World War I, when the Council of National Defense drafted a code covering some rules of the road. The real start was made in 1925, however, when the National Conference on Street and Highway Safety recommended that a committee draft a model code for States.

The National Conference on Street and Highway Safety, organized in 1924, was a cooperative movement whose chairman was the Honorable Herbert Hoover, then Secretary of Commerce. A number of national associations, alarmed at the rapidly increasing accident toll on highways, contributed to a budget to provide for a full-time secretary and the printing of reports, and these and other organizations generously lent the services of their staff members to carry on the extensive program of committee work.

At the first general session of the Conference in 1924, uniformity in traffic regulations was urged and, as it was apparent that there could not be uniformity without models, a Committee on Uniformity of Laws and Regulations was created to draft such models.

The National Conference of Commissioners on Uniform State

Laws had already created a committee for the same basic purpose. The two organizations joined forces, making the chairman of the Commissioners' committee chairman of the more widely representative committee selected for the National Conference on Street and Highway Safety. The new committee produced its first draft of the Uniform Vehicle Code in time for review and approval at the second general session of the National Conference in 1926.

The first Model Traffic Ordinance was drafted in 1928. Both Code and Ordinance were reviewed and harmonized in 1930 by the National Conference, and thereafter the National Conference maintained a committee to revise both standards from time to time to keep abreast of new developments. Subject to changes through death or retirement, and frequent injection of new blood, a substantial number of the early wheelhorses have remained in the picture throughout. Since 1933 the committee has been informally known as the Wellington Committee in respect for George R. Wellington, pioneer motor vehicle administrator of Rhode Island for many years and chairman of this committee until his resignation due to ill health a few months ago. His successor is Sidney J. Williams, Assistant to the President, National Safety Council. J. Allen Davis, General Counsel, Automobile Club of Southern California, has been the committee's legislative draftsman from the beginning.

Scope of Code

The 1926 Code contained three acts dealing respectively with the present subject matter in Acts, I, II and V. Present Acts III and IV were added in 1934.

The original Code contained 153 sections. The present Code contains 422 sections. Act V, regulating traffic on highways, has expanded from 73 to 210 sections, dealing with numerous traffic and equipment problems nonexistent in 1926.

Objectives in the Uniform Vehicle Code

In drafting the Uniform Vehicle Code the committee responsible for it has sought to provide a code (1) free from ambiguity and thus

easy to understand and enforce, (2) fair to highway users and thus likely to command their respect (3) adequate to protect their civil rights, and (4) sufficiently comprehensive to meet all commonly encountered conditions.

Many existing state codes and sections thereof not in conformity with the Code meet some but not all of these objectives. Concerning the first, for instance, we find in existing laws versions of rules with perhaps the same intent as in the Code, but so worded as to make their meanings uncertain. The result is varying court interpretations. Faulty definitions often cause confusion.

Speed restrictions illustrate the second objective. Not only at present do numerical limits differ widely, but a considerable number of states, though in the minority, hold to absolute limits. Admittedly it is much easier to clock a motorist at a certain figure and get a court conviction than to prove under a prima facie rule that his speed was unsafe for the existing conditions. However, the National Committee has debated the matter at length and has always held to the prima facie rule under which the burden of proof shifts from prosecutor to defendant at the speed indicated in the Code. Convictions are harder to obtain, but conscientious drivers are less likely to be convicted by a mathematical formula when they are endangering nobody. And on the other hand, if apprehended going too fast on a slippery road or in heavy traffic, drivers do not have the defense that they were within the stated limits.

Variations in right-of-way rules illustrate the third objective. The old rule, unhappily still in effect in some states, giving the operator on a through street absolute right-of-way over traffic from a side street, virtually deprives the driver from the side street of any defense in a civil action if he is hit, even though he has waited for vehicles within a reasonable distance and is run into by a speeding driver who had ample opportunity to slow down. The National Committee holds it to be unfair to set up such a barrier to cross traffic and the Code authorizes such traffic to proceed after it has stopped for all through traffic so near as to constitute an immediate hazard.

As to the fourth objective, some state codes are silent on important matters. For example, the Laws and Ordinances report of

the President's Highway Safety Conference shows twenty-one states with no traffic signal legend. They leave to the police and the courts to determine whether a motorist running through a red light or bumping a pedestrian while making a right turn has in fact committed any offense. Yet the National Committee deems this of such importance as to devote more than a page to it. Six states do not say whether a pedestrian has any rights or duties. Seven accord rights but no duties.

A number of state codes, probably the result of many short acts adopted over the years, are a conglomeration of unrelated subjects, often in fine print and long paragraphs. They contain overlaps if not outright contradictions. Compliance with and enforcement of such codes are obviously difficult when it is hard to tell what the law is.

Model Traffic Ordinance

The Code makes the state law paramount. It prevents municipalities from establishing speed limits and operating rules at variance with accepted practice. To give the municipalities reasonable control over traffic within their boundaries, however, the Model Traffic Ordinance has been developed. Dovetailing with the Code, it gives the cities authority to designate one-way streets, set up parking restrictions and otherwise determine purely local requirements.

While the Uniform Vehicle Code is designed for precise adoption, it is recognized that the needs of municipalities, and the amount of traffic legislation desirable, vary widely. The Model Traffic Ordinance, as its name implies, is a comprehensive document intended to provide cities large and small with as much or as little as their conditions require. A greatly abbreviated edition may suffice for a small community, while virtually all of it may be appropriate for a metropolis. Every section, however, has been drafted with care, to carry out the intent of the section and minimize the problems of interpretation and enforcement.

The Model Ordinance dovetails with the Uniform Code. Obviously, however, its provisions cannot be adopted where they will conflict with existing state law not in line with the Code. Also, constitutional or enforcement requirements vary among the states. In

some states state-law provisions need to be repeated in ordinances. In others they do not.

For these and other reasons the President's Highway Safety Conference recommends that in every state a statewide agency prepare a state model ordinance, patterned as closely as feasible after the Model Traffic Ordinance, but adapted to the conditions in the state. Such agencies, it is held, should also maintain on file copies of the existing ordinances in the state, and give information and aid to the municipalities in improving their ordinances.

Only a few states as yet have effective central agencies. In general the municipalities are on their own. We know many of them have used the Model Ordinance as their guide. We have no accurate information as to how many. A number of the Leagues of Municipalities are tackling the problem, however, and better and more orderly progress can be looked for in the future.

Manual on Uniform Traffic Control Devices

Though not a part of the Uniform Code or Model Ordinance, the Manual on Uniform Traffic Control Devices is closely related to them. The Manual is a consolidation and rearrangement of one for rural highways prepared by the American Association of State Highway Officials in 1925 and one for city streets developed by the American Engineering Council in 1929. The Joint Committee responsible for the Manual has equal representation from the American Association of State Highway Officials, Institute of Traffic Engineers, and National Committee on Uniform Traffic Laws and Ordinances.

The Uniform Vehicle Code directs the state highway authorities to adopt and put into effect a manual which "shall correlate with and so far as possible conform to the system then current as approved by the American Association of State Highway Officials." The Code also requires obedience to official traffic control devices. Since the Association is a sponsor of the Manual on Uniform Traffic Devices and most of the states have approved it, it has the effect of law when the state code includes these provisions of the Uniform Code. At the same time the way is left open for approved technological developments without the need for new legislation. And the Joint Com-

mittee meets at intervals of a few years to revise the Manual in the light of these developments.

Progress Towards Uniformity

Taking into account the meager and widely dissimilar traffic laws in 1926 when the first Code became available, the widespread though erroneous idea throughout most of the United States that driving a motor vehicle is a natural right, and the myriad events, pertinent or entirely extraneous, that can happen year after year in legislative bodies to prevent favorable action on good bills—we can see the great progress made in the first quarter century of the Uniform Vehicle Code.

Yet we must admit we still have a long way to go. Only a third of the states administer set-ups comparable to that of Act I. A third do not require certificates of title. South Dakota still sees no need for a driver's license; several others do not prescribe or enforce adequate examination of applicants, and still others fail to use the important disciplinary controls over bad drivers provided in Act II.

As for Act V, we credit twenty-seven states with it, and a number of other states have adopted parts of it, often verbatim. On the other hand, most if not all of the twenty-seven have omitted or materially modified important provisions of Act V. Only eight of the twenty-seven require periodical inspection of motor vehicles, and there are wide variances in speed restrictions, right-of-way, turning and other rules, lighting requirements and size and weight limits.

A material deterrent to uniformity in the north Atlantic and New England states has been that when the Code first became available these states were already, to a much greater degree than the less populous states, immersed in the traffic problem. Consequently they had adopted comprehensive laws that had jelled. This has not been too serious with respect to driver licenses, because some of them have in fact gone beyond the minimum standards of the Code. However, their lack of uniform rules of the road makes for confusion, especially because of small area and heavy traffic, and their relatively good safety records must be attributed to good motor vehicle adminis-

tration and other advanced procedures—certainly not to their traffic laws.

Thanks to the broad-mindedness and influence of its vehicle administrator at the time, Pennsylvania set a shining example back in 1927 when it scrapped its existing laws and adopted the first edition of the Code. Delaware followed suit shortly thereafter. But until very recent years, neighboring states and those in New England seemed impervious to the idea of uniformity. Each state seemed self-sufficient, though some of their archaic laws were not adapted to present-day conditions, and all differed from those of neighboring states. Happily a change of heart has prompted several to make comparative studies of their laws and the Code, as urged by the President's Highway Safety Conference. Several have recently written into their laws important sections or groups of sections of the Code, and Rhode Island early in 1950 adopted virtually the entire Code.

In other parts of the country a few of the states credited with Act V have accomplished this by writing into their existing laws the provisions they previously lacked. In large measure, however, they have followed the original Pennsylvania procedure. This is particularly true in the states where light traffic had produced relatively few traffic rules on which to build.

Resistance to adequate driver licensing as provided in Act II has existed virtually everywhere in the United States *except* in the north Atlantic and New England states. Even the populous Middle West long fought this alleged infringement on personal liberty, but states in various areas began seeing the light and between 1929 and 1939, thirty states adopted driver licensing. Some of them still fall short of effective examination of applicants and adequate suspension and revocation systems.

The table below shows the score to date with respect to Acts I, II, and V. Arizona and Rhode Island enacted programs in 1950, when only ten states were in regular legislative session. Alabama, Arkansas, Oklahoma, South Carolina and Tennessee qualified as to one or more of the Acts in 1949, in which year at least twenty-one states passed short bills in precise or substantial conformity with the Code.

STATES IN SUBSTANTIAL CONFORMITY WITH ACTS I, II AND V OF THE UNIFORM VEHICLE CODE

State	*Act I*	*Act II*	*Act V*	*State*	*Act I*	*Act II*	*Act V*
Alabama			yes	Montana			
Arizona			yes	Nebraska			
Arkansas	yes	yes	yes	Nevada		yes	
California	yes	yes	yes	New Hampshire			
Colorado		yes	yes	New Jersey			
Connecticut				New Mexico	yes	yes	yes
Delaware	yes	yes	yes	New York			
District of Columbia			yes	North Carolina	yes		
Florida		yes	yes	North Dakota	yes	yes	yes
Georgia				Ohio	yes	yes	yes
Idaho	yes	yes	yes	Oklahoma			yes
Illinois			yes	Oregon		yes	yes
Indiana				Pennsylvania	yes	yes	yes
Iowa			yes	Rhode Island	yes	yes	yes
Kansas		yes	yes	South Carolina		yes	yes
Kentucky				SouthDakota			
Louisiana				Tennessee	yes	yes	yes
Maine	yes	yes	yes	Texas		yes	yes
Maryland	yes	yes	yes	Utah	yes	yes	yes
Massachusetts				Vermont			
Michigan	yes	yes	yes	Virginia	yes	yes	
Minnesota		yes	yes	Washington	yes	yes	yes
Mississippi			yes	West Virginia	yes	yes	
Missouri				Wisconsin		yes	yes
				Wyoming		yes	

Total having Act I ——— 18
Act II ——— 27
Act V ——— 30

Revisions

Periodical revisions of the Code and Ordinance are necessary evils. Multiple-lane highways, complex intersections and signal layouts, one-way streets and many other modern highway improvements require new or expanded rules governing operation on them. Likewise advances in lighting and other vehicle changes, along with experience, have made it necessary to revise some basic rules. While the National Committee on Uniform Traffic Laws and Ordinances

does little pioneering, preferring to wait until a measure has been tried and proved desirable in several states, some experimentation has been inevitable, and a few mistakes have required correction.

Because of these periodical reviews states that have adopted parts of the Code need also to review their laws and bring them up to date. Utah did a thorough job in this respect in 1949, revising its version of Act V adopted in 1931. Other states have done this on a smaller scale, but many others need to do it, particularly with respect to rules of the road.

Fortunately recent reviews of the Code have brought little change in the fundamental rules, the amendments being rather in the nature of refinements and additions to meet new conditions.

Prospects

The President's Highway Safety Conference has given great impetus to the movement for uniformity. In accordance with Conference recommendations more and more states are holding statewide safety conferences stressing the importance of uniformity, and are making detailed comparisons of their state laws with the Uniform Vehicle Code to provide a sound basis for legislative action.

During the four years since the Conference was organized many states, heretofore lukewarm to the idea of uniformity, have to a substantial degree already legislated in line with the Code. And with the groundwork laid, there is good reason to hope that 1951 will be a banner year.

Transit and City Officials Cooperate in Traffic Improvement

G. H. FRIELING

Mr. Frieling is Vice President in Charge of Transportation, Kansas City Public Service Company. He is a Member of the American Society of Civil Engineers; of the administrative committee of the Operations Division and Chairman of the committee on Express Service of the American Transit Association, and a member of the American Society of Planning Officials. He is management member of the Missouri State Board of Mediation, President of the University of Michigan Club of Kansas City, and a member of several local civic associations.

KANSAS CITY is engaged in a centennial celebration. In looking back over what has been accomplished by Kansas Citians working together—at times against great odds—the time seems opportune to talk about cooperation.

In presenting the city's story on a nationwide broadcast, James Hilton, English author and program host said:

"Around about 100 years ago an American senator was on his way down the Missouri by steamboat. Reaching a bend in the river where there was already a small village perched on the high bluffs, he couldn't help but exclaim to his companions, 'Gentlemen, another generation will see a great city on those hills.' Tom Benton was this senator's name, and now a century later we celebrate the truth of his prophecy, the dream come true—the story of Kansas City, the story of a city that is at the crossroads of America."

The story of Kansas City was called one of courage, of struggles against hardship, of struggles against greed, and also one of *cooperation*. The people of Kansas City, it was said, had "a spirit." And as the city grew and the people accomplished many things which at first seemed impossible, the Kansas City Spirit became a legend. That spirit of cooperation has indeed been the force largely responsible for improving traffic conditions in this community.

Starting in 1821 as a trading center of several dozen families, "the

Town of Kansas" was incorporated in 1850 when its population totaled 700-odd. In the century following, it grew into what is now Greater Kansas City, one of the important metropolitan communities of the nation with a population of approximately 750,000. This includes Kansas City, Missouri; Kansas City, Kansas; North Kansas City, Missouri, and Independence, Missouri. In addition, the thousands of inhabitants of thriving suburbs use the streets of Greater Kansas City. The city has become a bustling community with streets bulging at the seams in the effort to accommodate the increasing number of automobiles and trucks as well as street cars, trolley buses, motor buses and taxicabs.

Municipal authorities are well aware of the present day traffic problems. They know that the value of any transportation artery is in proportion to the number of persons that can normally be moved through it in any given time. They know that limited funds are available for street widening, expressways, by-passes and other similar remedies. With an average of 1.7 persons per motor vehicle, most streets are able to accommodate only a comparatively small number of persons in comparison with the great number who might be transported over those same streets if more persons driving motor cars used public transportation.

When one transit vehicle can comfortably carry all the passengers of at least thirty automobiles, it is natural that most students of traffic encourage transit travel, particularly in places of heavy traffic. Where traffic congestion seriously impedes transportation, merchants and other business interests are immediately affected, and they too become concerned with the problem.

Passengers equal to the average loads of 162,387,631 cars were transported by buses and street cars in Greater Kansas City during the year 1949. They were carried over the life lines of the community by the most efficient users of street space.

One-Way Streets

Increasing congestion has placed more emphasis upon using many streets in one direction only and hence many streets have been made "one-way" streets. A committee composed of business leaders, city

traffic engineer, and transit officials studied this problem for some time and developed a plan that was put into effect. The plan necessitated changing the travel habits of the motoring public and also the re-routing of many transit lines to conform to the new pattern. The effect of the change decreases much traffic interference and permits a smoother flow of traffic through the arteries. The use of one-way streets tends to simplify turning movements. There is no doubt that some persons were inconvenienced by the plan but it is believed that the advantages justify the change.

Swing Lines

Marker or swing lines painted on the pavement at many locations have been advantageous as far as street-car turning-movement is concerned. The locations for these lines and the method of marking were worked out between the transit company and city officials. The police department is also quite interested in this and has given its active support and suggestions.

The routing of transit lines is also important as it affects traffic congestion in general. The primary purpose of any routing is to serve best the majority of persons using the transit line. But efficient operation demands a balance of that factor against a smooth flow of traffic in general. The City Plan Commission and the staff of the City Traffic Engineer have on many occasions studied this problem with the result that changes for betterment in traffic flow have been made.

Passenger Zones

Location and length of passenger zones have been worked out on a joint basis. The City Traffic Engineer directs the painting of street-car passenger zones and the installation of marker buttons. At many locations he has constructed a raised platform type of zone with a long, distinctive type of "nose" on the approaching end. The zones vary in length for single or double berthing depending upon the number of street cars using them.

The transit company paints the bus zones after the City Traffic Engineer has approved the location. Lengths of curb zones for motor

View looking north on Grand Avenue from 12th Street showing bus zones and standard type street car zones.

Downtown Kansas City, Mo., in the foreground. The Missouri River and Kansas City, Kans., in the background.

Looking north on Baltimore Avenue toward Ninth Street. A typical view of one-way street travel.

Raised concrete street car loading zone showing lighting and protecting abutment and "nose."

Some buses are short-looped in the downtown district to relieve points of heavy congestion.

Modern motor bus equipment operating through the famed Country Club Plaza at Christmastime.

buses and trolley buses have been standardized as a matter of policy, and also for efficient operation. Better handling of the bus in and out of the zone is accomplished when the zone length is of standard dimension.

A standard length also gives the City Traffic Engineer something definite to stand on when faced with complaints from property owners who sometimes believe that the zone in front of their establishment is too long. Zone lengths were agreed upon by the City Traffic Engineer and transit officials after a series of tests with various types of buses at a test location. The lengths of bus zones as agreed upon are as follows:

	Bus	*Length of Single Zones*		
Type	*Length*	*Near Side*	*Far Side*	*Mid Block*
Mack	35′–0″	85 ft.	55 ft.	100 ft.
Twin–41–S	32′–11½″	80 ft.	50 ft.	90 ft.
Twin–30–A	25′–10″	75 ft.	50 ft.	90 ft.
Twin–34–S	29′–2½″	75 ft.	50 ft.	90 ft.
Twin–44–D	34′–10″	80 ft.	55 ft.	95 ft.
Diesel	28′–4″	75 ft.	50 ft.	90 ft.
Ford	25′–9″	75 ft.	50 ft.	90 ft.
All Trolley Buses	35′ to 37′	85 ft.	55 ft.	100 ft.

When zones are used by buses of various types, the zone length for the longer bus is used. Where traffic demands, zone lengths are increased to allow two or three buses to load at the same time.

Curb Radii

Minor changes at intersections expedited traffic considerably. Where there was considerable turning movement, it was found that traffic was often slowed because of sharp corners or parking allowed close to the intersection. Transit officials have assisted the City Traffic Engineer by calling attention to some of these locations where the curb radii has been increased to allow a freer turning movement. This has eliminated the necessity for wide turns and permitted increased use of the curb lane. It has also been found that by placing signs, "No Parking Here to Corner," a short distance back of the intersection, it has opened the throat of the intersection to such an

extent that traffic has moved through it faster with greater safety, and turning movements were expedited.

Parking Restrictions

Through joint studies it was found that some streets even outside the so-called congested area have a traffic flow sufficient to require "No Parking" restrictions placed in the rush-bound direction. On these streets the buses stay in the lane next to the curb, thereby causing a minimum of general traffic interference and at the same time speeding up the trip for the many thousands using the bus mode of travel. Effective means of studying such conditions have been to take movies from the top of a building along the street. Such movies are also a very effective means of convincing those who do not believe regulations are necessary.

Accident Prevention

Studies for accident prevention are of course a most important part of the work of transit officials as well as the City Traffic Engineer or the police department. The local Safety Council also lends what assistance it can to this work. Statistics as to accident locations are kept by all of us and where it is found that corrections are apparently necessary, joint studies are made and a solution is usually found. The police department as well as ourselves take pictures of accidents that have happened, as well as accident-prone locations. Pictures assist greatly in studies of this nature.

The problem of accident prevention of course starts with the individual location or person. It has long been said that safety is a matter of education, engineering and enforcement. Municipal authorities and police officials constantly apply these principles to the driving public. We do the same with our car and bus operators in an effort to make the streets of Kansas City safe. It might be well to state briefly our safety program.

Car and bus operators are selected only after careful screening. Various intelligence, interest and motor-ability tests are given to supplement the interviews. These are followed by a training course

Sgt. Paul Stahl of Kansas City, Mo., Police Department congratulating two transit operators, both of whom have operated their transit vehicles more than 30 years without a chargeable accident.

Off-street loading at waiting station by modern transit equipment.

of thirty to forty days under actual driving conditions. During this time competent instructors assist them. After they actually start work, the instructors continue to make periodical rides with them to observe their driving and correct errors.

Records are kept at each operating division of the operator's performance. These are reviewed with the man by the division superintendent at regular intervals. He also discusses each accident with the operator concerned no later than the day after it occurs.

Road supervisors who patrol the transit routes keep a watchful eye for any safety practice violation. They discuss the matter with the operator at the time and their authority extends to discipline if that is warranted.

When the operator's record falls somewhat below average, he is summoned to headquarters for a detailed discussion of it with the Superintendent of Safety, Training and Instruction Division. This conference is not for the purpose of reprimanding the man but to help him out of his difficulties if that is possible. However, it is made quite clear to him that he must show improvement or be dismissed from the service. A few men are brought in individually each week for such a conference. This part of the program has shown remarkable results.

Daily safety bulletins show the number and kind of accidents the previous day with comment regarding them. Additional bulletins on pertinent safety matters are posted at intervals. The monthly house organ also carries at least a page on this subject. Movies on safety are used to good advantage. This is all to keep the employees fully advised and alerted to this important matter. Spot announcement on the radio and newspaper advertisements give the story to the public.

Operators as well as road supervisors report accident hazards along the transit routes. If these hazards cannot be corrected by the transit company they are referred to the proper city official.

The over-all program is showing good results: During 1949, all classes of accidents were reduced more than 15 per cent under the previous year. The record this year to date is showing at least as great a reduction under the same period of 1949. From a total of approximately 1200 operators, 842 of them went through the year 1949

without a chargeable accident. This is the largest number for any year in the history of the company.

In the matter of accident prevention, the cooperation of the Police Department is essential. It is their duty to enforce safe driving practices and it is a privilege to work with them toward that end. That privilege extends to the municipal judges as well.

Service Interruption

When a parade or other large attraction is being planned, the problems are reviewed with police officials so that confusion in operation is minimized as much as possible. If it means that a one-way street, for example, should be opened temporarily to two-way travel, such arrangements can be made before trouble is encountered.

In cases of road re-surfacing programs or other temporary impediments to the normal flow of traffic, transit road supervisors work side by side with the police to expedite the traffic movement. This is of course also true in cases of large fires, severe accidents, and the like.

Snow and Ice Conditions

During the winter months when snow and ice are on the streets, the transit company enjoys the cooperation of several divisions of the Public Works Department of the city in combating those conditions. Both the city and transit company have much snow fighting equipment. Prior to the winter months a meeting is held with the city authorities to map out the procedure to be followed in snow storms. Such planning minimizes duplication of effort, reduces expenses and keeps more streets in a safe operating condition. Generally speaking, the transit company plows, sweeps, or spreads abrasives on most of the transit routes while the city men concentrate on the downtown area and streets other than transit routes.

Southwest Trafficway

The State Highway Department in cooperation with the city and the Public Roads Administration is presently constructing an expressway from the downtown area to the southwest section of the city.

This will be known as the Southwest Trafficway. Through cooperation of those agencies with transit officials, the plans of a long viaduct include bus loading bays with steps leading from them down to Southwest Boulevard where transfer connections may be made with other transit routes. Loading bays for buses will also be constructed at other points along the expressway. Long runways from the bays have been provided so as to give a gradual exit from or entrance to the expressway.

It is anticipated that some express service will be operated over the Southwest Trafficway. Express service is presently operated on some other routes which gives an improved service to many patrons. It also improves the traffic situation by eliminating the stops and starts in traffic over a large section of the routes by many buses.

Street Lighting

Under the general direction of the City Traffic Engineer, a greatly improved system of street lighting has been in progress. The transit company benefits greatly from this improvement. The modern fixtures spaced in a better pattern direct much more illumination to the pavement. Even though the fixtures extend out over the pavement, trees adjacent to them are trimmed to minimize shadows. The new lights aid the pedestrian to a great extent. The lighting improvement should reduce the night accident rate.

Origin and Destination Survey

A few years ago, the State Highway Departments of Missouri and Kansas, in cooperation with the Federal Government and local agencies, conducted a comprehensive origin and destination survey in the Greater Kansas City area. Transit officials assisted in the development of the questionnaire and made the complete analysis of the transit data obtained.

Although the survey was made on a sample basis, it fairly well established the average number of daily trips, the purpose for which they were taken and the zones of origin and destination. Additional data were also obtained for more detailed study.

The transit company was in the process of developing its post-

war modernization program at the time. As riding was declining from the war-time high level, company officials were interested in conserving route miles while still giving adequate service and the most direct service wherever possible. The origin and destination survey assisted greatly in the development of the program.

Conclusion

There have been many mutual problems solved by full cooperation between municipal authorities and transit officials. Each group had confidence in the other that the best solution was being sought. Many mutual problems still lie ahead, but with cooperation as a keynote a satisfactory answer to the problems can be developed.

The trend since the war is an increasing number of auto registrations. The automobile has become more and more a part of the American way of life. Most new houses have the garage attached. Short trips that only recently were made on foot are now taken by using the auto. The cost is not often taken into consideration.

On the other hand, in spite of modernization of plant and equipment, the trend of transit riding has been declining. The cost of providing service has not been reduced, except for what service cuts can be made, and from the national picture it is doubtful that a downward trend in costs to any great extent can be looked for in the near future.

The rate of fare is high for this type of industry. Every increase in fare causes a substantial reduction in transit riding. In many cases it means another passenger car on the streets. It may be that already the point of diminishing returns has been reached in the fare structure. It was not expected that transit riding would remain at the war level but to what level will it recede? It is generally conceded that public transportation is vital to a city and necessary to business activity; but to function properly it must show a profit.

It is recognized that cities too must have sufficient revenue to function properly but question is raised as to whether transit is being unduly burdened. It is subjected to heavy loads in the way of special obligations and taxes. These of course must be passed on to the passenger. Should transit passengers be asked to carry this load when so many others get the real benefit?

One of the burdens is the responsibility for pavement between the car tracks. This is apparently an inheritance from horse-car days. Certainly the volume of motor vehicle traffic today does much more damage to that pavement than does the modern street car. On many streets the space between the tracks is the principal area of travel of all traffic.

Another burden is the responsibility of the transit company for the snow and ice removal and the spreading of abrasives. Under such weather conditions it is common to see traffic gravitate to the transit routes which are kept open for continuous service. The Public Works Department of the city has been doing a good job, however, on the other main arteries of travel.

Certain taxes make still another burden. Through these taxes it may well be that the transit passenger is called upon to pay more than his fair share of pavement maintenance and other costs. The decentralization trend now has thousands of persons living outside the city limits who work in the city. They use the streets of the city, yet pay little or nothing toward their construction or maintenance. Some cities in attempting to correct this inequity have imposed an income tax on all persons working in the city.

These are a few of the burdens. There are others. The transit company can no longer carry them and still remain solvent in the face of high costs and declining patronage. A solution must be found to give the city its needed revenue and yet relieve the transit company of charges it perhaps should no longer be expected to carry.

These important problems must be faced with courage. It is the responsibility of the transit officials to operate the company as efficiently as possible. That being done, the city officials should release the company of all unjust burdens as it is to the advantage of the city to have a prosperous public transportation system.

I have faith in the future and believe this will be worked out. Many problems have been solved cooperatively in the past, and there is no reason to believe that Kansas City's spirit will not prevail in the future.

Psychological Factors in Effective Traffic Control Devices

A. R. LAUER

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EARLY in the development of our highways, various roads were designated by name and symbol. Since there was little difference in the surfacing or grading between main roads and secondary roads, it was customary to put some type of trail markers on the telephone poles such as a red circle for the "Red Ball Road," a yellow diamond for the "Diamond Trail," a white band for the "Great White Way."

Thousands of roads were so marked throughout the country, largely as guides to venturesome motorists who strayed out of their immediate community. Directions were given to take the "Air Line" to Podunkville, the "Blue Arrow" to Jericho, the "Kings Highway" to Jones' Corners, and so on. There was no system, no coordination or logical planning of routes.

Towns and cities were anxious to have tourists stop for gas and supplies. Thus competing routes were established with special inducements posted such as the "short line," "water level route," "scenic views" and others. The tourist was often driven about the country in wild goose chases and frequently led to travel many more miles than necessary to get to his destination.

A little later markers were used much more sensibly, due to the influence of road builders, motor clubs and other interested agencies. Signs and markers varied in size from a few inches long and two or three inches wide to others almost as large as poster panels used by outdoor advertising concerns.

Some signposts were a clutter of names and in a study reported by the writer (1933) some corners took as high as twenty seconds for even a college student with good vision to read all the markers and fully comprehend the directions indicated. The motorist with defective vision, fatigued by travel and not used to reading for detail, would need up to a minute to decide which road he must take to reach his destination.

The next phase was an improvement in which engineers decided by arm-chair methods on the shape, color, and lettering to go into a standard system.

The late W. F. Rosenwald of the Minneapolis Highway Department one time explained to the writer the present road-marking system as it was discussed and adopted. A certain committee was formed and met to decide on what factors should be considered. Since the square or rectangular sign was common to signs in general, it had to be used for posting speed limits, danger points and other directions to motorists. It was therefore thought desirable to use this sign for purposes of instruction and warning to drivers of conditions along the roadway proper. It was then suggested that the square sign be rotated 90 degrees and warnings of danger on the roadway proper be placed on it; such as dip, hill, slow, curve. Even such non-specific warnings as *danger* are frequently seen on the highways, a diamond-shaped sign being used.

Then it was deemed advisable to have a special form for Stop signs. Someone proposed that the corners be cut off and the octagonal sign restricted for this purpose. Unfortunately this reduced the size and available space to about 83 per cent of the square and diamond-shaped sign of the same diameter for the most important one of all. Likewise, a round sign was reserved for railroads and it has but 78 per cent of the area of a square sign. Thus the two most important signs were made considerably smaller, unless the diameters were increased with a corresponding loss in materials.

Furthermore, markers were adopted with small letters, even six inches and less for Stop signs. The motorist was ignored entirely, and with increasing speeds and correspondingly longer stopping distances, many markers became entirely inadequate. Lauer and Helwig (1932) published a paper advocating the use of reflectorized

paints for signs, particularly the Stop sign. Neal (1946) showed considerable advantage in the reflectorized sign. Some time later, reflectorization became much more widely used.

It has been shown by Lauer (1947) and others that square or diamond-shaped signs can be distinguished at twice the distance at which the best legends on them can be perceived correctly. On the other hand, legends on round or octagonal signs could be read much sooner than the shape could be accurately discriminated. This means that the shapes of round or octagonal signs are actually worthless for the purposes they were intended.

Some provinces in Canada use pictographic signs—a pictured idea of the direction of the main road and side roads. Psychologically this system has much to recommend it. Observation made of drivers at our laboratory indicated that, under test conditions, a driver in his own car would be much less likely to err in turning the proper direction when a pointing arrow was used rather than a small marker having R for right-hand turn or L for left-hand turn. It is said that during the Civil War soldiers actually had trouble in marching to "right, left, right, left, right," hence hay was tied to one foot and straw to the other—thus "hay-foot, straw-foot" came into our language.

The Motorist's Inning

The motorist has been quite left out of the picture. The merchant has beckoned him to stop and spend his money. The towns, cities and municipalities have tended to confuse him with variously-worded, numerous and often conflicting directions. Engineers have attempted to reduce the confusion by adopting somewhat unreadable signs of standard type, and the economists have contributed by keeping the size down to save paint and materials.

Mr. John Doe Motorist is not perfect. His eyesight is not 20/20 by any means. The average driver has vision of about 20/23 instead of 20/20. Some states give licenses to persons with 20/70 vision; many drivers are on the road with 20/200 vision, which legally entitles a person to a blind pension. Instead of reading a Stop sign eight inches in height at 448 feet distance, such persons can read it at only forty-five feet. At 70 miles an hour, it takes 490 feet to make a safe and sane stop (not minimum stopping distance.) A person with 20/70 vision

should not drive over thirty miles an hour to be able to stop after reading such a marker, which is larger than some still being used, the legends of which are only six inches in height. These calculations are for the best possible driving conditions—clear atmosphere, broad daylight and dry pavement.

Improvements Which Have Been Made

Even though the driver has not been given the necessary attention, much improvement has been made in traffic signals. Some of the most important developments and innovations may be outlined as follows:

Standardization: Although not yet entirely accomplished, much progress has been made. Some standardizations are unwarranted from experimental data obtained, but they still help to bring order out of chaos. Much remains to be done, particularly with respect to placement of signs and markers. Some wide variations are to be noted in this respect.

Letter Types: More legible signs are being used. The old-type square letters are being superseded by oval type letters which are much more legible. Spacings are being recognized as a factor in legibility. The proper balance between stroke and spacing is being scientifically adjusted.

Size of Letters and Signs: Signs are being made larger, and Iowa, as well as certain other states, is experimenting with 12-inch letter Stop signs. When the size is inadequate, additional warning signs are sometimes used well in advance of the sign proper. Forbes and Holmes (1939) presented valuable data on factors of legibility in the design of highway sign legends.

FIGURE 1

This figure represents an idealized type of stop sign constructed according to principles derived from the study. Slight artist's modifications were made to equalize the legibility of letters in the Gestalt of the word STOP. Dimensions: 25 Percent Stroke, 25 Percent Modification on "S," "T," and "O," 50 Percent Spacing.

Studies reported by the writer (1947) indicate the proper utiliza-

tion of factors such as stroke, width-height ratio, and shape of letters would increase the efficiency by nearly 25 per cent. See Figure 1.

Colors: Standard colors are quite generally followed throughout the country. Yellow-orange seems to be best for all-year purposes, especially for target value. California has experimented some with signs having a red background which seems a natural color for this purpose. While red required the least light for discrimination as red, it required most light for perception of form such as round, square, etc. New York has used a lemon-yellow for background. This color has some advantage in contrast-ratio which is an important factor in legibility but it loses slightly in target value when the trees and surroundings are covered with snow. However, it also has some advantage in the autumn when the leaves turn red, yellow and brown.

Because of the Purkinje Phenomenon, a deep orange tends to appear darker in low illumination thus reducing the contrast-ratio with a black legend. This effect may be overcome by using black reflectorized letters which would show up well in darkness when headlights are being used.

Placement of Signs: While great strides have been made in this respect, much remains to be done. Figures 2 and 3 show extremes in this respect. The upper sign of Figure 2 is practically on the track and is also poorly maintained. Fortunately, the railroad warning stands out in bold relief and the corner is lighted. The lower marker of the same figure is reflectorized and placed back in position to give the driver more warning.

The optimal distance of highway railroad markers from the tracks has never been ascertained by experimental methods. Apparently any rules set forth in the regulation manuals are not rigidly followed.

Likewise, Figure 3 shows wide variation in distance of placement from the corner. Not only is the sign at the top out almost to the sidewalk line but it is almost completely obscured with foliage until one is nearly upon it.

Until recently, the sign was practically invisible due to branches which have been partly removed. In the same locality another sign was entirely invisible to the driver of an approaching car until with-

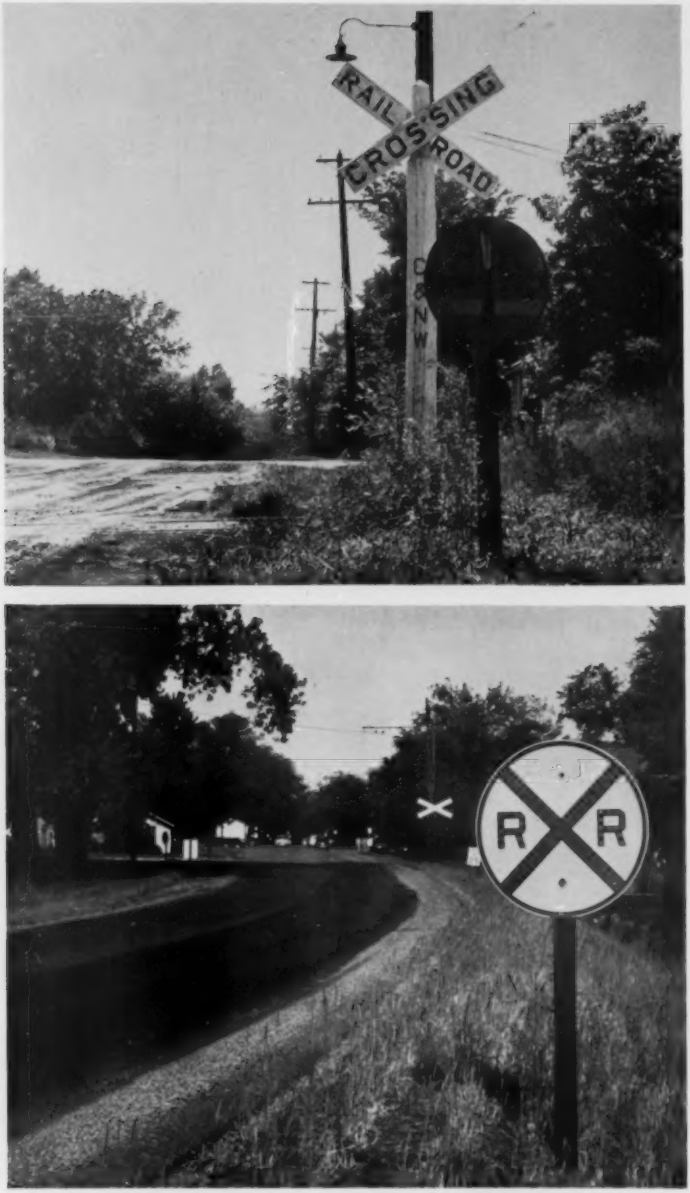

FIGURE 2. Distance from railroad track. These two photographs show samples of practices in placing the sign.

FIGURE 3. Variation in distance-from-corner in placing signs is often confusing.

FIGURE 4. Maintenance of signs is often grossly neglected.

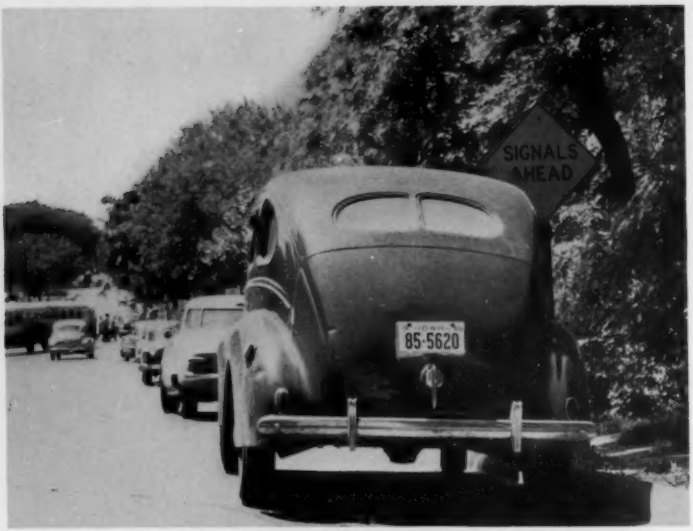

FIGURE 5. High enough vertical placement gives greater value.

SUGGESTIONS FOR MAKING STOP AND GO LIGHTS
MORE MEANINGFUL AND EFFICIENT

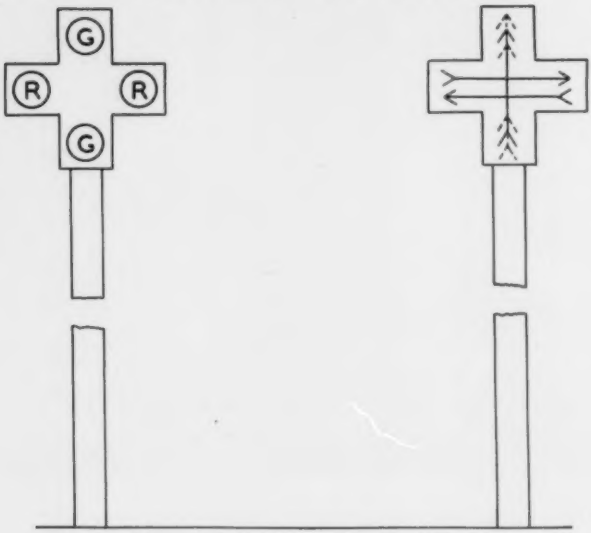

FIGURE 6. A signal light which would have more attention value and clearer meaning.

in 30 feet of the corner. Much needs to be done in determining the most effective placement.

Maintenance: This is a most important phase of highway marking. Figure 4 shows the need for greater attention to this feature. The left marker is badly in need of paint and would be almost valueless at night in its present condition. The right marker is cluttered up with various other informational signs which greatly reduces the effectiveness of any of them. Such practices are certainly not conducive to effectiveness from the psychological point of view.

Figure 5 shows a desirable practice in efficient sign placement. The marker is placed high enough to show somewhat above the car. In some places double signs are placed one above the other to increase their efficiency. A high sign is not in the direct beam of the headlight and therefore may well be supplemented by a duplicate sign placed lower on the same post.

Reflectorization: The greatest improvement so far made in highway markers is in reflectorization. Any reasonably maintained marker can be seen in daylight but after dark reflectorization has an enormous advantage. A good reflectorized stimulus can be seen and identified at several times the distance at which its non-reflectorized counterpart becomes visible.

Further improvement of this aspect of markers will take place in the next few years. Only a beginning has been made and manufacturers are constantly striving to turn out more efficient products. Whereas one reflectorized material gave only a 4:1 reflection ratio before the war, it now has been built up to a 220:1 ratio as compared with flat white paint.

Methods of utilization are also being explored. It seems entirely possible to create illusory movement by using patterns of materials having varying angular reflection characteristics.

STOP and GO Signals

The matter of placement of Stop and Go lights has always presented a problem. Some installations are on one side, some on both

and some overhead. Although the use of four-corner installation is general, many exceptions are to be found in our towns and cities. Three fundamental psychological principles should be noted as follows:

1. All lights should be placed at the same angle of vision at a given distance from the driver's seat. This would bring about the greatest likelihood of being noticed.

2. The angle of declination should be the least possible to obtain with adequate clearance of lights at the side or above.

3. When used in a remote district, there should always be an orange flasher or other warning signal used and should be limited in use to such purposes. It might be possible to differentiate the type of Stop signal by varying the flash intervals. A rapidly flashing orange light (perhaps ½ second per cycle) might indicate a Stop light and a very slow flashing rate (perhaps once every four or five seconds) might indicate an ordinary Stop sign.

Much progress has been made in establishing the optimal intervals for certain specific conditions, although, unfortunately, municipalities do not always make proper use of facts available. Traffic-actuated and pedestrian-actuated signals have value in certain specific locations. Their use should be carefully studied, however, before installations are made.

The green has been shifted from yellowish-green to a blue-green which is a particular advantage to color-blind drivers. This greatly reduces the number of persons who would be confused by the red and green lights. Although national standards have been adopted for the position of the red and green lens, it does not seem that a universal practice has been reached as to which is placed above—red or green.

Two suggestions for consideration are shown in Figure 6. The top shows a design of Stop and Go lights which would give clear indication of the direction of traffic flow and would have a great deal of advantage from the standpoint of securing attention. The sign at the left would alternately flash across in red, giving an illusion of movement or the conventional phi-phenomenon effect commonly used at railroad crossings. The vertical pattern would alternately flash for movement ahead or Go. It would not greatly complicate manufacture and would give a decided psychological advantage to

the motorist. Under test conditions, 93 per cent of lights were missed by contestants in the Ford Good Driver's League finalists when they were competing for a $5,000 scholarship. This is quite good evidence that many persons go through red lights because they do not notice them.

Another possibility shown at the right of Figure 6 should have considerable merit. Instead of lights, neon arrows would indicate the direction of traffic flow and with some slight variation might even give the illusion of movement commonly noted on business signs.

Channelization Markers

A wide variety of these markers have been used, such as painting the word Stop on the pavement, diagonal lines laid down before railroads, etc. We will confine our remarks here to the consideration of center-lines and barrier-lines. In the main there is a strong tendency to standardize markings according to recommendations made by the Bureau of Public Roads. Some 17 patterns are still used in which two basic variables seem to be identified:

a. Those of color: either white, yellow or black in order of frequency.

b. Those of pattern in which the alternatives are dashed lines and solid lines with considerable variation in practice.

A committee of the Highway Research Board, in a recent study (1950) has considered this matter at length, and it seems that standardization of design is of more immediate importance than standardization of color. It confuses and irritates motorists, when driving from one state to another, to find the barrier line on one side of the center line, then on the other, or even in the center of the lane when crossing state lines. Again, they are confused when only one line is used which in a few states is still the practice. The types of center-line striping patterns are shown in Figure 7.

The practice of whether barrier-line or center-line is "dashed" or "solid" also varies. Researches are now under way to ascertain which particular system is the most effective and least confusing.

A higher degree of standardization would help reduce confusion. Traffic control devices must be designed so that the driver is least

confused and helped the most. Psychological factors seem to have been given secondary consideration in the evolution of highway markers. As researches progress, this appears to be more and more in evidence. So far as the driver is concerned, it is one of the most important.

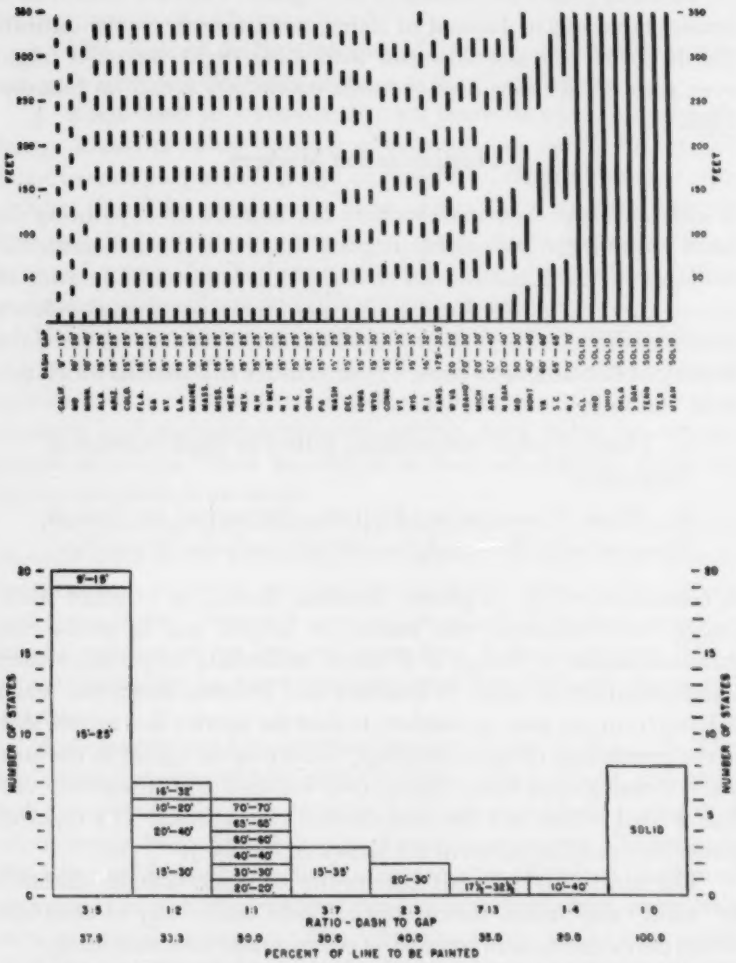

FIGURE 7. Variation in center-line markings. Channelization practices are in need of greater uniformity.

Again we find the paradoxical situation in which practices often need to be standardized before the basic facts which govern their use and effectiveness are known. In this case it is sometimes possible to change over rather gradually, and by utilization of the great molding machinery of driver education throughout the country, this may be accomplished with a minimum of delay.

California for example at one time instigated right turns on a red light. They designed a sign which indicated when a motorist might turn. Later the plan worked so well that it was extended. Since so many markers were needed, they finally changed over so that one might turn right on any red light unless it was marked otherwise. The shift seemed to be accomplished with the minimum amount of confusion.

Experimental studies of psychological nature are needed in numerous phases of highway design and marking. It is hoped that more persons with fundamental training in experimental psychology may be enlisted to attack the numerous problems needing study.

Many of these problems are fundamental in nature and solutions to them would be of use in other phases of our society. The ideal situation seems to be a close cooperation between traffic engineers and psychologists interested and trained in the work.

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The Roadside Problem

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COMMERCIAL exploitation of rural highway roadsides deprives the tax-paying road user of a full return for his highway dollar: Undirected roadside development fosters congestion, increases accident rates and in general raises the overall cost of vehicular transportation.

The problem has been recognized all right. Safety organizations have pointed to roadside business structures, indiscriminately placed, often with poorly engineered points of exit and entrance, as a prime factor in increased accident rates and congestion.

Students of highway economics just as positively credit miscellaneous roadside commercial enterprise, or "ribbon" development, with introducing distorted characteristics into the normal growth of land values in the vicinity of the motorway, characteristics indirectly responsible for certain increases in transportational costs; while the public in general, and civic-minded garden clubs in particular, have long deplored the spoiling of natural scenic beauty and consequent driver distraction resulting when such roadside activity has continued unchecked.

Prior to the advent of the gasoline-powered automobile, the roadside "problem" did not exist. If anything, the services of the roadside were insufficient to serve even the basic needs and desires of hardy wayfarers who risked overland travel.

The motor vehicle altered the idyllic picture of the rural roadside, practically overnight as history is measured. The impact of the automobile on business was first felt in urban areas. For in the beginning, the radius of operation of the new invention was limited. The gas pump in front of the village store was probably the first outward sign of the new transportational form that in a few years, had far-reaching effects on all fields of commerce and industry and that touched the life of every man, woman and child in the nation.

Although its official birth took place during the last decade of the

19th century, it was not until the years immediately following World War I that the automotive industry shook off its infantile characteristics and began to assume its ultimate role as one of the most powerful influences on our national economy. During the ten-year period, 1919–1929, motor-vehicle registrations in the United States soared from 7.6 millions to 26.5 millions. This 250 per cent increase was brought about, in part, through technical improvements. These improvements affected the efficiency and convenience of automotive travel and added impetus to the plea for better roads—a plea started by cycling clubs at the turn of the century.

Enough has been said of the 1920's "golden era" of road building to dismiss it here with only the mention of its having been the beginning of the roadside "problem" as we know it today. For, the laying down during the 1920s of what has proved to be the basis of a national roadway network, unparalleled in history, gave the intrepid motorist the means of driving even farther from home than previously contemplated. And it created a real need for adequate roadside services of an automotive nature to speed him on his way. At this point in our history, the alert American entrepreneur became aware of the potential market on the roadway. It was a market that might patronize other than the normal adjuncts of automotive travel. And the commercial exodus to the rural roadside was on.

From this beginning, the population of the rural roadway margin with business establishments has progressed at such a rate that today on many of the more heavily traveled thoroughfares, the duplication and multiplicity of similar businesses and the location of commercial pursuits totally unrelated to automotive fields constitute a menace to safe, efficient highway travel. This is the real roadside problem.

A major contributory factor to the rapid growth of the roadside problem is found in parking problems that have plagued cities for the last two decades. Recognizing the situation, many merchants have moved to the outlying areas of cities where space is available to provide the adequate parking facilities so essential to the economic soundness of the many retail commercial pursuits that depend on public patronage. Thus may be seen the development of the circumstances which have, in effect, made the arterial approaches to many

cities function as city streets by lining them solidly on both sides with commercial establishments.

Another fact adds to the import of the roadside problem: On roadways where no roadside controls direct and contain the growth of marginal business enterprises, the commercial development is roughly in proportion to the traffic volume of the road. A recent study in Connecticut, utilizing data from the 1938 and 1948 statewide highway planning surveys, showed the approximate ratio of business establishments, each with its own private driveway, per mile per 1000 vehicle increment of average daily traffic to be 0.616 for 1938 and 0.944 for 1948.[1]

This 53.3 per cent growth in rural roadside commerce was not matched by the 43.6 per cent gain, from 440,335 in 1938 to 632,053 in 1948, in Connecticut motor-vehicle registrations. What then will be the condition of Connecticut's roadside problem in 1960, when conservative estimates put the vehicle registration in the 1,200,000 range?

Continually expanding commercial exploitation of the rural roadside coupled with the increased susceptibility to outside interferences that the traffic stream has acquired through higher average speeds and increased vehicle volumes indicates that the situation is far from being arrested or even stabilized.

The detrimental traffic consequences of this haphazard and heterogeneous rural wayside commercial activity are many and varied. Among the more obvious are:

Multiplication of Access Points: Uncontrolled location of business interests along the traveled way margin has resulted in the placement of frequent driveways and curb-cuts, often poorly designed and maintained, thereby increasing proportionately the points of possible conflict and encouraging the incidence of conditions which induce accidents.

Increased Turning Movements: Hand in hand with the multiplication of access points goes the increase in turning movements, for the motorist desiring to avail himself of the roadside services

1 *"Rural Roadway Traffic Volumes as Related to Roadside Commercial and Residential Development,"* E. G. Mogren, Thesis, Bureau of Highway Traffic, Yale University, May 1950.

offered must turn out of the through-traffic stream, where protected parking areas are provided and must later re-enter it at less than through-traffic speed.

Larger Speed Differential Within Traffic Stream: Each individual unit of commercial development along the roadside is the site of a potential point of interruption to the through-traffic stream. Such sporadic interruptions tend to maximize the difference in speed between successive vehicles, thereby creating a condition of hazard between vehicles within the traffic stream in addition to the one created between the entering or exiting vehicle and the traffic stream.

Unsafe Parking Practices: Where no protected off-the-road parking spaces are provided, the customer-driver must park along the pavement edge at the expense of the safety and comfort of the through-traffic stream.

Driver Distraction: The many billboards and attention-attracting devices employed to extol the merits of the competing business interests along the roadway margin provide an added degree of hazard by diverting motorist attention from the roadway ahead.

Increased Pedestrian Activity: The location of business establishments along the roadway edge greatly increases the number of pedestrians in the area. Pedestrian fatalities, while walking along the rural highway, accounted for 14 per cent of the total pedestrian fatalities which occurred during 1949.

The effects of these various factors attending unrestricted roadside development are most easily identifiable in the destruction and obliteration of rural scenery, a lessening of the capacity of the roadway to accommodate vehicular traffic, an increase in the frequency of accidents on the rural highway and decreases upon the property values in the adjacent areas.

Rural Scenery: In addition to the utilitarian aspects of roads and roadway construction, the individual states and the nation as a whole have become cognizant of the aesthetic and operational considerations of adequate landscape treatment of the highway roadside. Somewhat belatedly, it is being realized that beautiful, well cared-for highways represent a business asset which provides a continuing

income and reflects benefits in increased driver safety and comfort. Tourist revenue in some states runs into hundreds of millions of dollars annually. The roadside inhabited by a close succession of low-order business structures such as hot-dog stands and wayside zoos destroys the natural scenic attraction of any route, and can mean the subsequent loss of inestimable amounts of tourist dollars to a state.

Adequate landscaping and shoulder development control are also proving of value in minimizing roadway maintenance costs.

Roadway Capacity: Traffic congestion on rural highways has been an important concern of the traffic engineer for a number of years. Primarily, the problem stems from the greater volumes of traffic generated by ever-increasing vehicle ownership coupled with more extensive usage. While this factor is recognized, it is perhaps less widely appreciated that miscellaneous roadside structures exert a strong influence on roadway traffic which is manifested in increased congestion and a consequent lessening in roadway capacity.

Extensive studies made recently by the Bureau of Public Roads, into the vehicle accommodation characteristics of roadways while operating under various conditions, point up the fact that the efficiency of any pavement for transmitting vehicles is directly impaired by the possibility of roadside-created interruptions.[2] What then is the operational efficiency of the Baltimore-Washington Boulevard, for instance? A survey made in 1940 disclosed the startling fact that this 30.5 mile stretch of roadway was encumbered by 618 commercial establishments, 665 residences and 2450 billboards and signs.[3] Considering only the commercial establishments, because of their increased traffic potential as compared with residences; if evenly spaced throughout the length of the route they would present a point of entry or exit every 260 feet, or every six seconds to the driver proceeding at a cautious 30 miles per hour.

Other equally severe examples can be cited, such as the 47-mile long state routes 25 and 26 in New Jersey, whereon a commercial

2 *"Highway Capacity Manual,"* Committee on Highway Capacity, Department of Traffic and Operation, Highway Research Board, Washington, D. C. 1950.

3 *"Roadside Control,"* Research Report No. 5, Research Division, Maryland Legislative Council, 1940.

driveway, intersecting road, street or railway at grade faces the driver every 275 feet throughout the route length.[4]

Without question, comparable situations could be cited in every state of the Union.

Accidents: The most forceful argument against indiscriminate roadside development is presented by the huge accident toll suffered on the rural highways year in and year out. Appalling losses in human life and property damage continue unabated on the rural highway. Thirty-one thousand, five hundred persons lost their lives on American streets and highways during the calendar year of 1949. This figure represents an approximate 2 per cent reduction over the total number of fatalities for 1948. But, buried amid the preponderance of statistics setting forth the 1949 accident toll is the indisputable fact that the 2 per cent reduction was accounted for entirely in the urban areas—the rural highway with its ever-increasing roadside-created traffic hazards incurred an overall increase of 3 per cent in 1949 fatalities to continue its upward trend which has, except for the war years, never been interrupted.

Property Values: An investigation of the trends in property values along regulated and unregulated highway roadsides is one that should be spread over a period of years. The immediate view may be totally different from the long-time conclusions. Today the potential commercial uses to which property adjoining the new or newly improved roadway may be put endows the owner of that property with a substantial potential unearned appreciation. However, use of the rural highway roadside for such commercial pursuits contributes to the early obsolescence of the facility as an efficient and attractive artery, thus eventually destroying the original value itself. Where regulatory methods, be they land use zoning or control of access, deprive the landowner of this immediate unearned realization, they tend to enhance the value of a deeper area of land on each side of the road and to a greater extent. Stated more simply, as long as the highway is preserved for vehicular transportation at its original efficiency and attractiveness, the surrounding areas are opened up to a considerable depth for stable, aesthetically accept-

[4] *"Public Control of Highway Access and Roadside Development,"* D. R. Levin, Public Roads Administration, Federal Works Agency, G.P.O., Washington, D. C. 1947.

able, suburban development. In this manner, the benefits accruing from the road are spread over more individual properties and the taxable basis is increased substantially.[5]

Need for Regulatory Control

Today, through gasoline taxes and license and vehicle registration fees, the motorist pays the major portion of the highway cost. It is economically absurd that these funds, representing a yearly public investment running into hundreds of millions of dollars, are expended for construction and reconstruction projects which, because of inadequate roadside control, become functionally obsolescent in a relatively short time and do not provide a continuing degree of transport safety, convenience and efficiency commensurate with the magnitude of the investment.

Relocation of those roadways which have become insufficient trafficwise, because of roadside conditions, is always violently opposed by the very merchants responsible for the decrease in roadway efficiency. Provision of better facilities for the motorist who actually pays for the road, is condemned as tantamount to armed robbery of the roadside commercial interests who do not pay for the road except when they leave their stores and join the ranks of the millions of motorists. Many instances are known where commercial opposition was overcome and alternate routes installed only to have the problem continue unabated because organized groups were able to prevent the adequate signing and marking of the new facility which would have diverted traffic from the area of intense roadside development. Such selfish activity must be curbed if the road user is to receive some of the values in safe efficient transportation for which he is paying.

Methods of Roadside Development Control

Many methods for combating the unsightly and hazardous blight of random roadside development have been advocated. State control of access to the rural highways would effectively solve the problem but the economic and social feasibility of ever controlling more than a

[5] Op. cit., Maryland Legislative Council.

slight percentage of the entire national highway system by such means is highly questionable. Other less drastic control measures for the protection of the thousands of miles of U. S. highways which serve appreciable daily volumes of traffic are land-use zoning, right-of-way reservation and the license or permit systems for access point establishment.

Control of Access: A high degree of containment of roadside development along certain important arteries has been achieved through the invocation of control of access legislation. With this procedure, the rights of light, air and access of the property owners along the motorway are extinguished in the interests of general public safety. Entrance to and exit from this type of facility is directed by the state highway organization and such control effectively discourages indiscriminate roadside population. However, the deep-rooted American concept of highways as public ways open to all, works at odds with this manner of roadway administration. While it is true that in the beginning, highways were placed primarily to serve abutting and immediately adjacent properties, the consequences of increased traffic requirements have made necessary the revaluation of certain roadways as being primarily for service to the traffic demand.

Special legislation is required for the creation of the limited access facility. To date, thirty-two states have provided such legal sanction circumventing the ancient rights of the abutting property owner in the interest of public safety. The states in which such legislation has been adopted and in which are located a total of 5567.14 miles of controlled access highways, are as follows:

1. California
2. Colorado
3. Connecticut
4. Delaware
5. Florida
6. Georgia
7. Illinois
8. Indiana
9. Kentucky
10. Louisiana
11. Maine
12. Maryland
13. Massachusetts
14. Michigan
15. Minnesota
16. Missouri
17. New Hampshire
18. New Jersey
19. New Mexico
20. New York
21. Ohio
22. Oklahoma

23. Oregon
24. Pennsylvania
25. Rhode Island
26. Texas
27. Utah
28. Virginia
29. Washington
30. West Virginia
31. Wisconsin
32. Wyoming

Control of access legislation is functionally feasible only in the case of new or lately constructed facilities. Application of the concept to established routes as a means of arresting or discontinuing roadside activity is hampered by the necessity for providing alternate means of access for properties isolated from the roadway in the process. In the case of a heavily commercialized roadside, the expense involved in such an undertaking could not be easily justified.

Quite obviously the concept of access control is most ideally adaptable to high volume throughways and is not warranted on the many thousands of rural mileage serving lesser volumes of traffic. Therefore less drastic control measures must be instituted for their protection.

Land-Use Zoning: Rural roadside land-use control is merely the regulation by zoning methods of the uses to which lands immediately adjacent to the roadway may be put. The procedure is administered under the state police power in the interests of general public welfare and safety.

Every state has some form of land-use enabling legislation, but successful applications of the concept, trafficwise, are few. Authority to zone is vested in all cities, towns and villages by 43 states (including D. C.) in all cities by four states, and in special classes of cities by two states.[6] Certain counties in California, Georgia, Washington and Connecticut have made successful use of this method in combating roadside commercial exploitation but for the most part the zoning procedure has been ineffective. The main reason for the ineffectiveness of zoning as a means of containing roadside development is found in its being administered by the lesser governmental units and therefore extremely susceptible to local influences. To the small city and town, the protection of the roadside to benefit through traffic is not a matter of local interest. In fact, residents of the smaller

[6] Op. cit., "Public Control of Highway Access and Roadside Development."

community quite often feel that benefits may be had by them through commercial development of their rural roadsides.

Uniformity in zoning of the rural roadside is necessary if the required inflexible control is to be realized. Protection of the rural roadside and subsequent traffic betterment should be the concern of the motorists of the state as a whole; therefore the logical agency to administer such protective measures should be at the state level.

Right-of-Way Reservation: One of the newer means advanced for controlling roadside usage is the right-of-way reservation or highway-development rights method. Under this plan the state highway department acquires either by police power or eminent domain the rights of development of a suitably dimensioned strip of land on either side of the roadway sufficient to preclude the possibility of any extraneous development which might prove detrimental to either present or future traffic. Owners of such abutting land retain all the privileges of ownership except the right to develop the land in a manner not consistent with the traffic needs of the roadway. The acquisition of such rights and subsequent reservation of rights-of-way, even on those roadways subjected to intense roadside enterprise has the effect of immediately arresting further expansion of marginal development. The legality of this method of roadside protection hinges on the proposition that any agency which has the right to take private property for highway development also has the authority to reserve private property for the same purpose in accordance with a recorded plan.

Ohio has instituted the previously mentioned procedure in acquiring lands for the proposed Cincinnati-Cleveland expressway. The results of this pilot application are being observed closely in the hope that another valuable tool for maintaining an efficient highway system may have been found.

Permit or License System for Access Point Establishment: Another of the less drastic measures instituted for the regulation of roadside commercialization is the permit or license system for access point establishment. Under this procedure it is necessary that a permit be obtained from the state highway department before the establishment of any access points on a state highway. Ideally, then, those access points requested which will tend to impede or endanger traf-

fic may be refused. Through such control, excessive numbers of access points can be prevented and the placement of parallel service facilities more judiciously located.

While many states now require that a permit be obtained before an entrance or exit point through the highway right-of-way may be built, it is unfortunate that the granting of such leave is, in most cases, little more than a ministerial act on the part of the State Highway Department. The governing factor, all too often, is the extent to which drainage will be accommodated in and around the opening. Without minimizing the necessity for adequate investigation of the drainage characteristics involved in driveway, design and placement, it is suggested that at least the same amount of attention should be directed to the traffic conflicts that can result from a poorly located or executed curb opening.

Design standards and specifications for driveways based on proved traffic engineering principles go hand in hand with the permit or license system of access point establishment, and help to insure the traffic adequacy of the proposed points of entrance and exit.

With the added degree of safety that is imparted to motor vehicle travel in rural areas when such minimum standards of driveway design are effected, it is unfortunate that only one out of every five states sees fit to take advantage of the procedure. Were the rest of the states to follow the lead of California, Louisiana, Maryland, Michigan, Minnesota, Nebraska, New Jersey, North Carolina, Texas and Virginia in providing city, county and state officials, as well as real estate developers and individual home builders with such helpful information in attractive, easy-to-use booklet form, the traffic benefits realized would be substantial.

Need for Factual Studies

Progress to date in the regulation of roadside uses has been notably inadequate. One of the main deterrents to the control programs advocated has been the lack of understanding on the part of the legislators and the motoring public of the gravity of the situation and the urgent need for strong corrective measures. The origin, growth

and whole effect of the problem emanating from the roadside have been so gradual as to be mistaken for the normal price that must be paid for the convenience of modern vehicular travel. This is not so. Studies recently initiated in a number of states will soon yield facts which will emphasize the detrimental relationships that exist when random roadside development is allowed and the traffic good that can be derived when adequate roadside control measures are instituted.

Michigan Study: The degree to which roadside-located structures influence the causation of accidents on the highway is one phase of a vital study now under way in the state of Michigan. In this survey, the Michigan State Highway Department is tabulating frequency distributions of highway accidents for various distances from specific roadside and pavement design features. Correlation coefficients are also being determined between the number of accidents and number of roadside and roadway features for each of the test road sections being studied. Only preliminary results have been reported thus far, based on the analysis of 3000 accidents, but certain significant conclusions seem to be forming which point to a greater reliability of correlation between roadside development and roadway accidents than between roadway design features and roadway accidents. The preliminary analyses indicate that the correlation coefficients of accidents and specific highway and roadside features are as follows:

Correlation coefficient of accidents with roadside features	0.79
Correlation coefficient of accidents with pavement design features	0.61
Correlation coefficient of accidents with advertising signs	0.41

Minnesota Study: Minnesota's study covers some 500 miles of rural and urban state highways. First-stage study of approximately one-third of the mileage under surveillance indicates that there exists a fairly well defined relationship between the frequency of highway access points and accident occurrence. Completion of the analysis of the total mileage involved should fortify arguments for roadside control.

Iowa Study: The results of the Iowa State study recently completed under the direction of Professor P. H. Elwood, Head of the

Department of Landscape Architecture at Iowa State College determined that highway accidents occur more frequently in the areas of heavy roadside population along highways approaching the cities.

Legislative Interest Needed

Increasing legislative recognition is being accorded roadside development as an element detrimental to safe traffic movement, the latest decision being one handed down by the Supreme Court of California in the litigation HOLLOWAY, et al vs. PURCELL, Director of Department of Public Works et al. In this significant finding, the right of the California State Highway Commission to relocate, and redesignate as a freeway, a portion of State Route 3 was affirmed over the protestations of a group of taxpayers, some of whom were owners of businesses located along the old route.

In upholding the statutory and constitutional authority of the State Highway Commission to redesignate the to-be-relocated route as a freeway, the court had this to say: "The type of highway adequate to meet traffic needs necessarily varies with the character and extent of those needs. Highways adequate for the horse and buggy traffic of 1902 are not adequate for the high speed motor traffic of 1950."

In answer to another point raised by the plaintiffs relative to the loss of business which those operating business establishments along the original Route 3 would sustain, the court stated that "construction of the highway past their places of business gave them no vested right to insist that it would remain there," and quoted from the Virginia case of MCMINN VS. ANDERSON (52 S.E. (2nd), 67) to the effect that the landowners protesting relocation of a state highway had for twenty-five years enjoyed the benefits of a greater volume of traffic by their lands than might travel thereby after the new road was opened, but were now insisting upon an extension and perpetuation of those rights and advantages, that they might have a changeless road in a changing world."[7]

More of such enlightened legislative action is necessary if con-

[7] Highway Research Correlation Service, Circular No. 117, Highway Research Board, Washington, D. C. September 1950.

tinuing progress is to be made in correcting the problem of the roadside. One method of stimulating this beneficial understanding on the part of legislative bodies and the public is to continue factual studies, of the type briefly described, which accurately delineate the importance of roadside features as they affect roadway efficiency.

Thorough analyses of such studies will provide the intimate details of roadway operation as it is influenced by roadside development and will aid immeasurably in the formulation of intelligent, equitable methods of roadside control acceptable to highway administrators, affected property owners and automobile drivers alike.

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